Determinants of the Adaption of Organic Agriculture in Egypt Using a Duration Analysis Technique

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Abstract

A very important pillar of the modernization of the Egyptian agriculture depends upon the exportation of the high value added products such as organic products. In spite of the importance of the organic agriculture within the Egyptian agriculture sector and up to our knowledge, it does not exist in Egypt until now any study that try to determine and analyze the determinant factors of the adaption of the organic agriculture within the Egyptian farms. In this study, we focus on this issue. A survey with a representative sample of organic and non-organic farms in Upper Egypt area was carried out. Using obtained data set we apply duration analysis techniques to assess the effect of different explanatory variables on both the adoption of organic agriculture farming and the timing of this adoption. Our results suggest that the maximum hazard of adopting organic agriculture takes place during the first few years after the construction of the farm and Manager characteristics such as his education level and Risk behaviour together with the farm size seem to be the most significant factors affecting the likelihood of organic agriculture adoption in Egypt.. These results could be helpful in designing the suitable policies and strategies to support the extension of organic agriculture within Egypt.

Key words: organic agriculture, duration analysis, Egypt.

JEL classification: C41, Q1

1. Introduction

A very important pillar of the modernization of the Egyptian agriculture depends upon the exportation of the high value added products such as organic products. In spite of the importance of the organic agriculture within the Egyptian agriculture sector and up to our knowledge, it does not exist in Egypt until now any study that try to determine and analyze the determinant factors of the adaption of the organic agriculture within the Egyptian farms.

The main objective of this paper consists of determining and analysing the most important factors in the adaption of organic agriculture and the duration of this decision in Egypt, which will be helpful in designing the suitable policies and strategies to support the extension of organic agriculture within Egypt.

In order to achieve the aforementioned objective we carried out a survey with a representative sample of organic and non-organic farms in the Upper Egypt area namely in Suhag, Assiut and Fayum governorates, which considered as the main production area of organic products.

The methodological approach is based on the use of different survival or duration analysis techniques which allow controlling both for the occurrence of an event (i.e. whether a farm adopt the organic agriculture or not) and the timing of the event (that is, when the adoption takes place).

Our results and consistent with previous literature suggest that the Maximum hazard of adopting organic agriculture takes place during the first few years after the construction of the farm. Manager characteristics such as his education level and Risk behaviour together with the farm size seem to be the most significant factors affecting the likelihood of organic agriculture adoption in Egypt. These results could be helpful to

policy makers in designing the suitable policies and strategies to support the extension of organic agriculture within Egypt.

The rest of the paper is organized as follows. Section 2 provides a brief description on the Egyptian organic agriculture sector. The methodological approach applied in the analysis is explained in section 3. Our empirical application and the main results are discussed in sections 4 and 5, respectively. Finally, the paper ends with some concluding remarks.

2. The Egyptian organic agriculture sector

Although the contribution of agriculture has fallen, it still accounts for about 17 per cent of gross domestic product and 20 per cent of total exports and foreign-exchange earnings. In addition, industries related to agriculture, such as processing, marketing and input supplies, account for another 20 per cent of gross domestic product. Agriculture is therefore a key sector in the Egyptian economy, providing livelihoods for 55 per cent of the population (UNDP, 2004).

Egypt's approximately 460 organic farms covered an area of 24 548 hectares , 0.72% of its total agricultural land in 2007, and almost half of the farms area located in the middle Nile, concentrated in the region of El Fayoum, 100 Km south of Cairo. More than half of the organic farms in Egypt are 4.5 to 20 hectars in size. There are only a few farm enterprises larger than 1000 Feddan (ca. 400 hectares), but they account for 20 percent of all organic farmland, and are located in reclaimed desert land in the Nile delta and in Upper Egypt.

Certified Organic Agriculture started in Egypt 23 years ago in a small farm (SEKEM) of about 17 ha in the eastern desert to produce medicinal herbs for the export market. Expansion of this activity was quite slow until 1988. Thereafter a rapid growth occurred in the bio-dynamic production of vegetables, fruits, cereals, and cotton, beside the

medicinal herbs. This rapid growth was initiated mainly by Sekem and some other growers in Fayum and Kalubia governorates. The expansion of Organic Agriculture activity in Egypt is growing very fast due to public awareness as well as the increasing demands for organic food and fibres in both local and export markets.

The main issues facing the progress of organic agriculture in Egypt can be summarised in: 1. Some regulatory aspects concerning the long conversion period (three years) in the EU rules. EU conversion requirements set as in most European countries the growing season is no more than 4 – 5 months per year. In Egypt there are three growing season a year. Also the manure limits per unit area is quite low for the desert soils which is very poor in organic matter contents, (less than 0.1%). In addition to some other regional differences related to the desert climate prevailing in the country. 2. The availability of organic seeds is not assured always, sometimes not found and If available are very expensive. There are no local organic seed production for many products particularly vegetables. 3. Disease and insect control still not easy, biological control agents are imported and expensive. Local practices need to be developed through intensive research programmes. 4. Nitrogen requirements still not fulfilled according to the allowed rates of application in all national and international rules and regulations. More research activities are needed for soil fertility conservation in the desert environment.

3. Methods: Duration analysis

Our methodological approach is based on the use of different survival or duration analysis (DA) techniques which were originally applied in biometrics. Since the seminal paper by Lancaster (1978) on the duration of unemployment, its use in economic analysis has spread out. In the field of agricultural economics, the implementation of this approach has focused on production technology adoption or the adoption of organic

farming (see Burton et al., 2003, de Souza et al., 1999 and Kallas et al., 2010, among others). However, to our knowledge, this is the first attempt to apply duration analysis to assess the adoption of organic agriculture in Egypt.

Survival or duration analysis techniques allow controlling both for the occurrence of an event (i.e. whether a farm adopt the organic agriculture or not) and the timing of the event (that is, when the adoption takes place). Therefore, these methods take into account the evolution of the adoption of organic agriculture and its determinants over time. Moreover, duration analysis techniques are appropriate to account for right censoring (when we only know that the farm did not adopt organic agriculture at least up to a given period t), and easily handle time-varying covariates. The latter allows overcoming the limitation arising from considering farm's characteristics previous to the sample period or at the time of starting as the unique determinant of farm survival over time. Furthermore, the specification of these models may be made flexible enough so as to allow testing the different predictions derived from the theory.

The central concept in survival analysis is the hazard rate. Following Kalbfleisch and Prentice (1980), this is defined as the probability that a farm adopt organic agriculture in a moment t given that it has survived until this period t and conditional on a vector of covariates Xit , which may include both time varying and time-constant variables,

where T is a non-negative random variable (duration), which we assume continuous, so that λ (t) is an instantaneous reduction rate.

In order to examine the effect of the explanatory variables on the adoption of organic agriculture we follow two approaches. First, we carry out univariate non-parametric tests of equality of hazard (or survival) functions across the r-groups of farms obtained

according to the values of each explanatory variable (Cleves et al., 2004). These tests are extensions for censored data of non-parametric rank tests used to compare two or more distributions. Under the null hypothesis, there is no difference in the hazard rate for each of the r groups at any of the failure times and this statistic distributes as a $\chi 2$ with $r - 1$ degrees of freedom.

Secondly, a multivariate analysis is undertaken estimating a semiparametric survival model in order to unravel the effect of each of the explanatory variables on the adoption rate (alternatively, the probability of survival) controlling simultaneously for the effect of the other variables considered. The estimation is performed using the semi-parametric CPHM, Cox (1972):

$$\lambda (t ; Xit) = \lambda 0(t) . \exp (Xit\beta)$$

where $\lambda 0$ (t) represents the baseline function obtained for values of covariates equal to 0 (Xit = 0). In this specification, the effect of the independent variables is a parallel shift of the baseline function, which is estimated for all those firms that survive up to a particular period. The baseline function is left unspecified and the model is estimated maximizing a partial likelihood function with respect to the vector of coefficients β without the need to estimate the baseline function (although it may be recovered non-parametrically).

The CPHM has some desirable properties that make it suitable for our analysis. First, the baseline function is left unspecified. Hence, the potential problem of unobserved heterogeneity that may rise when the baseline unction is not properly specified is overcome (Dolton and Van-der-Klauw, 1995). This problem worsens in presence of time-varying covariates. Second, it is only the ordering of the adoption times what matters for the estimation of the CPHM, and not the actual times by themselves.

4. Empirical application

Our data set comes from a survey designed and conducted in Upper Egypt, Specifically in Suhag, El Fayum and El Minya Governorates during the year 2010 for 60 representative organic and non organic farms.

The analysed event is the adoption of organic agriculture by a farm in a specific year. And we considered the construction of each firm as our time origin.

Regarding our estimation procedure, first we conduct univariate non-parametric tests of equality for hazard (or survival) functions across r groups of households obtained according to the values of each explanatory variable. Secondly, a multivariate analysis is undertaken by estimating a semiparametric survival function in order to unravel the effect of each explanatory variable on the likelihood of reduction, controlling simultaneously for the effect of the other variables considered.

Table 1 represents a description of the explanatory variables used in our analysis and the average value for these variables in the case of organic and non-organic farms.

Table 1 Descriptive statistics of the Duration analysis explanatory variables

Variable	**Description**	**Conventional farms**		**Organic farms**	
		Mean	**St. Dev.**	**Mean**	**St. Dev.**
Size	Farm size in Fedan	39.6	40.3	11.4	18.8
Age^2	The age of the farm manager squared	44.2	10.55	45.6	9.5
Family member	Number of the member of the family of the farm manager	4.7	1.7	5.4	2.2
Education	Dummy variable equals one in the case of having at least university education and equals zero otherwise	0.36	0.09	0.47	0.31
Training	Number of training courses the manager has during last three years	3.3	4.7	2.2	2.7
Risk	Degree of risk that the manager is willing to undertake	1.48	1.7	4.7	2.9
Accident	Dummy variable equals one in the case of having accident using agrochemicals and equals zero otherwise	0.21	0.41	0.30	0.47

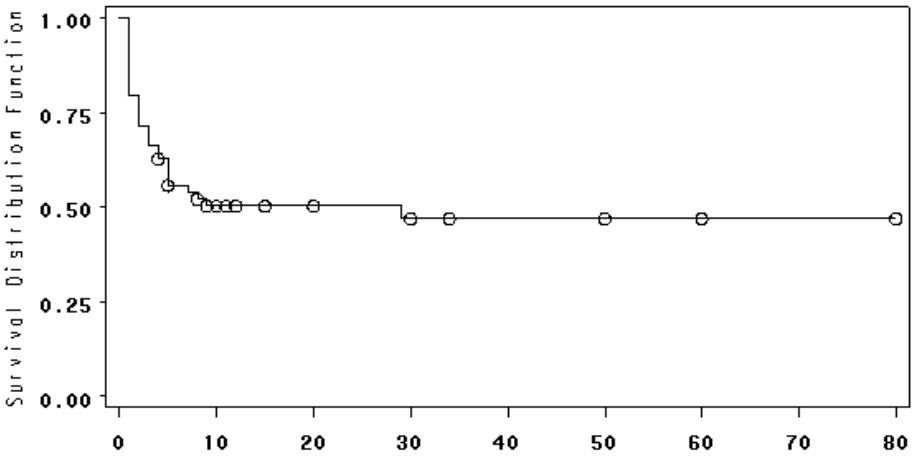
5. Results

Our results indicates that conventional farmers consider the low prices of organic products and high investment needed as the most important constraints of the adoption of organic agriculture while marketing problems and the un availability of information are considered the least important. In the case of organic farms the saturated market with conventional products and the low revenue are the most important constraint while the least one are the marketing problems and the long transformation period.

For conventional farms the most important motivation to cultivate organic products are the positive expectation regarding the exportation market and to avoid health problems related to using agrochemicals while the least important motivation is the self satisfaction cultivating healthy products. In the case of organic farms the least important motivation is the high cost of conventional agricultural inputs while the most important are the positive demand expectation in both domestic and international market together with avoiding health problems related to the use of agrochemicals.

Figure 1 shows the survival function from our data set. As can be observed, the highest probability of adopting organic agriculture takes place during the very first few years of the farm construction then this probability goes down until become stable and low from the tenth year approximately and thereafter.

Figure 1 The survival function



The CPHM was estimated with the selected explanatory variables, taking into account both that our data are right censored and the tied data problem[1]. Estimated parameters are shown in Table 1. As can be observed, the null hypothesis that all coefficients are equal to zero can be rejected with a 99% confidence level.

Our results suggest that Manager Characteristics such as his education level and Risk behaviour together with the farm size seem to be the most significant factors affecting the likelihood of organic agriculture adoption in Egypt. The farm size seems to be the most important determinant of the organic agriculture adoption where the null hypothesis regarding the impact from farm size can be rejected with 99% confidence. The hazard ratio is around 1, indicating that farm size decrease lead to increase organic agriculture adoption hazard of about the same magnitude. This negative effect of the farm size on the organic agriculture adoption may be owing to the high cost of the organic agriculture comparing to conventional agriculture this may make the farmer able to pay this high cost only in the case of small farm size. The other significant two

[1] As the duration model was originally designed for biometric data, where the event occurs for each individual in a different point of time, tied data is a problem that appears when applying duration models to economic data, where the event occurs for many individuals at the same point in time. In this study we have controlled for this problem to derive unbiased results.

variables are the education level of the farm manager and his risk behaviour which are significant at 95% and 90% confidence level respectively. Both variables have an positive effect on the organic agriculture adoption. In both cases this positive effect is expected and consistent with previous literature. Normally well educated people understand better the advantage of organic agriculture and are more willing to conducting it. Also as the organic agriculture, especially in the developing countries such as Egypt perceived as a risky activity so only risk takers managers will be willing to adopt organic agriculture.

Table 1. Estimated parameters of the Cox proportional hazard model

Variable	Parameter	St. Dev.	P-value	Hazard ratio
Size	-0.03*	0.02	0.07	0.96
Age^2	0.00	0.00	0.49	1.00
Family member	0.04	0.13	0.76	1.04
Education	0.419**	0.21	0.046	1.52
Training	0.02	0.07	0.79	1.02
Risk	0.30***	0.09	0.00	1.34
Accident	0.72	0.59	0.22	2.06
Likelihood Ratio: 47.38 (0.000) Wald test: 58.34 (0.000) Lagrange Multiplier Test: 38.26 (0.000)				

*, ** and *** indicate significant at 90%, 95% and 99% level of significance respectively

6. Concluding remarks

This paper presents the first attempt of using Duration analysis approach to determine the main factors affecting both the occurrence and the timing of the adoption of organic agriculture within the Egyptian Farms.

In this study a Duration Analysis approach, the Cox Proportional Hazard Model (CPHM), has been used to determine the main factors affecting both the occurrence and the timing of organic agriculture adoption between a representative sample of farms in upper-Egypt. To achieve this objective, a survey has been designed and conducted among 60 representative organic and non-organic farms.

Our results and consistent with previous literature suggest that the Maximum hazard of adopting organic agriculture takes place during the first few years after the construction of the farm. Manager characteristics such as his education level and Risk behaviour together with the farm size seem to be the most significant factors affecting the likelihood of organic agriculture adoption in Egypt. These results could be helpful to policy makers in designing the suitable policies and strategies to support the extension of organic agriculture within Egypt.

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