What determines the economic links among organic farmers? Empirical evidence from Argentina

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Introduction

Farmers are part of a competitive world system of production choices and costs, governmental support programs, market delivery systems, sources and pricing of inputs. Market globalization, products' differentiation, agricultural industrialization, advances in food chemistry and technology, processing and packaging innovations, concentration at the retail level, contracting and integration, and new organisational forms affect farming and consumers' decisions.

The nature of risk in agriculture is changing substantially. Concerns about the environment, food safety, animal health and treatment, conservation, land use, food costs and labor conditions are among forces that impose additional requirements for larger investment, planning and management skills.

Consumers' food taste is changing, due largely to advertising and marketing. They demand specific product attributes which include safety, convenience, quality, location, health and nutrition, ethical issues, and processes attributes such as environmental quality, animal welfare or genetic modifications. The demand is generated at the retail level and passed back to producers, who have little or no input in the process. Thus, farmers are asked to produce what is demanded when the buyer demands it (Baarda, 2002).

The nature of government support provided to farmers has also changed. There are multiple mechanisms such as food safety regulations, production subsidies and govermental assistance programs through which policy measures may affect producers' decisions. The competition in this new context requires the development of skills and adaptive strategies to maintain market positioning and access to high value market niches. In the case of Argentina, the strategy of seeking higher prices through quality, food safety, certifications (organic, fair trade) and labeling has been adopted by many producers as well as promoted by the government and other institutions. However, the markets for these products are more imperfect than the conventional ones. Efficiency losses caused by market failures have been one of the most important drivers to encourage producers' associations and other linkages across the market.

The objective of this paper is to investigate the extent to which Argentinian organic producers operate in an associated way and which the determinants of this decision are. We model the links among farmers using count regression models in which the dependent variable is the number of links established by each surveyed farmer. The interviews were conducted between November 2004 and February 2005.

The paper is organized as follows. Section one presents some theoretical discussion about the factors mentioned by the economic literature which explain the producers' association, particularly focused on the organic sector. Section two overviews organic production in Argentina and describes the data used. Section three presents the econometric model and analyses the empirical results. The paper ends with some concluding remarks.

Theoretical discussion

The main economic discussions about the factors determining the producers' association focuses on: economies of scale, market power, risk and uncertainty, externalities in the adoption of new technologies and transaction costs related to collective actions.

Economies of scale: An increase in the production level leads to economies of scale when large fixed costs such as assets acquisition, certification costs and human capital investment exist. Although large producers and processors can achieve economies of scale, lowering per unit cost of production, individual farms may be too small to match these economies. In order to move up in the product chain and capture additional value added, small farmers require larger financial resources to invest in capital goods. So, by joining forces, small producers can achieve economies of scale in purchasing inputs, processing, marketing and distribution.

Conveying accurate demand information through the industry's chain, from consumers back to farmers, presents another challenge. In order to succeed, farmers must grow the right products at the right time and deliver them to the right place. However, even with access to information about the consumers´ desire, organic farmers must reach markets, negociate terms and deliver the product while simultaneously preserving organic quality and integrity. Therefore, organic farmers have to deal with increased logistic, control and training costs and they improve efficiency through collective action.

Market power. Bargaining power, or lack thereof, has almost always been of concern to farmers. But it is an ever –increasing problem because of the increasing concentration of retailers and industry. In the organic sector, market power on demand side is more associated with wholesalers' requirements for high quality standards and adequate quantities than with lower prices. In the case of Argentina, most organic farmers have access to international markets, either through few and large domestic brokers or through wholesalers abroad who trade using their own certification labels. Another source of market power comes from certification suppliers since only few national firms have international presence to certify export products. In consequence, certification becomes costly to small producers who try to reduce the burden by sharing it when it is possible.

Risk and uncertainty: Since organic market is characterized as a niche, business opportunities are limited to well-informed and connected market agents. Links among producers increase human capital. Increasing linkages contribute to benefit less experienced farmers from others with superior capacity to identify new markets, negotiate contracts, explore new technological alternatives and exercise influence (de Janvry and Sadoulet, 2003).

Organic Sector in Argentina and Data

Argentina was the first developing country to have a national regulation adapted to the European Union and the first to enter the "third country" list. Its standards and national law date back to 1992. There are 12 national certifiers, some of them with a strong international presence. Currently, Argentina is the second country with the greatest organic area -2.4 million hectares-, after Australia. Nevertheless, a major part is extensive grassland.

In the nineties, organic production expanded at a rapid rate, as Figure 1 shows, because of international market opportunities and premium-prices. Since 2001, this growth has ceased as a consequence of economic crisis and monetary devaluation that made conventional production relatively more competitive than organic.

About 90% of the organic production has been oriented towards foreign markets, mainly to the European Union and USA. The main exports are cereals and oilseeds: corn, wheat, soy and sunflower. Fruits are also exported in large quantities: pears, apples, oranges and lemons, as well as some vegetables, especially garlic, onions and beans. Meat exporting began ten years ago with beef and, recently, Patagonian lamb exports have become relevant. The main processed products are: olive oil, sugar, juices, honey and wine.

Even though the government does not provide direct subsidies or economic aid for organic production, there are a number of institutions such as official export agencies, the National Agrarian Research Institute, universities and local governments that provide some non-financial support.

The survey was carried out in organic farms located in the main rural areas of the country where 121 producers were interviewed[1]. They were inquired about the activities they perform jointly with other farmers, classified in 15 topics differenciating between production-processing and marketing activities. The first group includes: 1) inputs purchase, 2) capital investment, 3) new technics adoption, 4) training, 5) certification, 6) to increase scale of output, 7) to obtain credits and 8) to be beneficiary of government supports. The second group includes: 9) capital investment, 10) training, 11) certification, 12) to obtain credits, 13) to increase marketing scale, 14) to access exports market and 15) to be beneficiary of

[1] According to national official reports there were 1.781 organic farms in 2004 (SENASA, 2005). The Northern Region is under-represented in the sample as consequence of the restrictions impossed by the large geographical dispersion in the country.

government supports.

Econometric Model and Empirical Results

The dependent variable is the number of links established by each farmer, which is the realization of nonnegative integer-valued random variables, i. e., farmers can establish zero, one, two, or *n* links (Figure 2). Therefore, a count data model is the appropriate technique to estimate the linking equation. Within this model the probability of a count is determined by a Poisson distribution, where the mean of the distribution is a function of the independent variables. The density of this distribution for the count (y) is given by:

$$\Pr(y/\mu) = \frac{e^{-\mu}.\mu^{y}}{y!} \quad \text{for } y = 0, 1, 2, \ldots \qquad (1)$$

where μ can be thought of as the mean or expected count. (Scott Long, 1997) This distribution has the defining characteristic that the variance equals the mean, a property known as equidispersion.

In the Poisson regression model, the number of events y has a Poisson distribution with a conditional mean that depends on individual´s characteristics according to the structural model. The most common formulation for μ is:

$$\mu_i = E(y_i \mid x_i) = e^{x_i \beta} \qquad (2)$$

Under the assumption that $(y_i|x_i)$ are independent, this model can be estimated by Maximum Likelihood. Provided the conditional mean function is correctly specified and the conditional distribution of y is Poisson, the MLE $\hat{\beta}$ is consistent, efficient and asymptotically normally distributed.

If the mean-variance equality is rejected, the model is misspecified. One common alternative to the Poisson model is to estimate the parametres of the model using maximum likelihood of a negative binomial specification, which allows the variance to exceed the mean (overdispersion).

$$V(y) = E(y)(1 + \alpha E(y) \quad (3)$$

The model NegBin II reflects the unobserved heterogeneity that the Poisson fails to capture by adding an additional parameter α. The Poisson model is a special case of the negative binomial when $\alpha = 0$ (Cameron and Trivedi, 1998).

$$\mu_i = E(y_i \mid x_i) = e^{x_i\beta}$$
$$V(y_i \mid x_i) = e^{x_i\beta}\left[1+\alpha.e^{x_i\beta}\right] \quad (4)$$

The recommended practice is to estimate both Poisson (PRM) and negative binomial (NBRM) models, and to perform a Wald test using the reported t statistic for the estimated α in the negative binomial model. Another test is the likelihood ratio, developed to examine the null hypothesis of no overdispersion, H_0: $\alpha=0$, which follows the Chi-squared distribution with one degree of freedom:

$$LR = 2*(\ln L_{NB} - \ln L_{poisson}) \sim \chi^2(1) \qquad (5)$$

If the null hypothesis is rejected, the NBRM is preferred to the PRM.

Zero-inflated models handle overdispersion by changing the mean structure to explicitly model the production of zero counts (Long, 1997). These models assume two latents groups. One is the always-zero group and the other is the not-always-zero group. Thus, zero counts come from the former group and some of the latter group with a certain probability.

The Voung´s statistic test compares the NBRM and ZINB models. If V is greater than 1,96, ZINB is preferred; if V is less than -1,96, the NBRM is favored; and otherwise neither model is preferred (Long, 1997).

The Poisson and the negative binomial models are non-linear regressions. The derivative of equation (2) with respect to any explanatory variable x_j, yielding:

$$\frac{\partial E(y_i)}{\partial x_j} = \beta_j e^{x_i\beta} = \beta_j E(y_i) \quad (6)$$

since $E(y_i) = e^{x_i\beta}$, according to equation (2). Rearranging equation (6) results in:

$$\beta_j = \frac{\partial E(y_i)}{\partial x_j}\frac{1}{E(y_i)} \quad (7)$$

β_j is a semielasticity that can be interpreted as a proportionate change in the conditional mean when the explanatory variable x_j changes by one unit.

Table 1 summarizes the variables included in the model and their means.

Before proceeding with the parametric analysis, we explore the robustness of the results using the Wald and *LR* defined by equation (5) tests to evaluate whether the data were over or underdispersed in order to select the appropriate count model. The results of these tests are displayed in Table 2 and they indicate some evidence of overdispersion. Therefore, the null hypothesis is rejected, implying that the PRM should not be used and the results are based on estimation of the NBRM.

The ZIBN is also estimated but the Vuong test, 1,58 < 1,96, suggests that this model is not preferred to NBRM.

The results of NBRM displayed in Table 1 indicate that the model performs well enough. Considering p ≤ 0,10, 13 out of 17 parameters are statistically significant and most of them have the expected sign.

The number of channels used by the farmers (QCHANNELS) has a positive effect on the number of links a farmer establishes with others. One additional channel increases the conditional mean of the links in 31,6 %. This result might suggest that those farmers who sell through multiple channels support major risk which may be compensated with more links. The number of products (QPRODUCTS) acts in the opposite direction. A diversified production reduces the risk and the potential benefits of collective action.

The different kinds of products have the expected signs with regard to the base category: MEATS. The production of industrial crops (IND CROP) has been promoted by government policies that encouraged the association. In the case of fruits and vegetables (FRUITS&VEG) the incentives to linkage are related to the perishable nature of these products. Finally, cereal producers (CEREALS) may benefit from economies of scale since this product is a commodity traded in large quantities.

The age of the person who manages the farm (AGE) and his/her degree in Agricultural Sciences (AG PROF) are proxies to human capital. Elder producers have more experience and may be reluctant to new relationships. In the same way, agricultural professionals give less value to the marginal benefits of being linked to other farmers.

On the other side, the strong dependence on family labor (FAMILY LABOR) might be a better proxy of small scale of production than farm size measured by dummies defined by the number of hectares (MEDSIZE and SMALLSIZE). The latter variables do not have the expected sign because most farms included in the base category (LARGE) are devoted to livestock production, which has been promoted by specific governmental programs.

The dummies for Regions (NORTHENREG, PAMPREG, CUYOREG, SOUTHREG) are control variables used to deal with heterogeneity coming from socio-cultural and economic differences.

Farmers linked with government programs (GOVSUP) are more likely connected among themselves because these programs usually require working in an associated way. Most of them include training actions which are more efficiently carried out in groups.

To manage additional activities involved in processing (PROCESS), farmers are more willing to establish links with other producers. Likewise, a greater number of links may be expected if they choose the strategy of establishing links for all the goods produced (ALLPROD) or if they are members of a formal association (FORMAL).

Concluding remarks

This paper provides a fresh approach to a widely analyzed issue in agricultural economics. The number of links among producers performs well as a proxy of a more complex phenomena. The extent to which producers choose to operate in an associated way, in the Argentinian organic sector, is mainly determined by the number of marketing channels used by the farmers, processing activities carried out, public support received, the scale of the farm and the kind of goods produced. This study contributes to understand farmer decisions about association. Moreover, the issue is particularly relevant to policy makers in developing countries where associations are promoted due to the emerging role of the social capital in the rural development policies design.

References

Baarda, J. 2002. 12 forces changing the face of farming and farmer cooperatives. Nov-Dic. [on line]

Cameron, C and Trivedi, P 1998. Regression Analysis of Count Data. Cambridge University Press.

Chang, M. And Schuster, E. 2003. Understanding the Organic Foods Supply Chain – Challenges and Opportunities from. Farm Gate to End Consumer.

de Janvry, A. and Sadoulet, E. 2003. Achieving Success in Rural Development: Toward Implementations of an Integral Approach. Proceeding of the 25th. International Conference of Agricultural Economists. August. Durban, South Africa.

IFOAM. 2005. The World of Organic Agriculture: Statistics and Emerging Trends Helga Willer and Minou Yussefi (Eds.) Bonn, Germany. 7th Revised Edition.

Scott Long, J. 1997. Regression Models for Categorical and Limited Dependent Variables. SAGE Publications.

SENASA. Situación de la Producción Orgánica Argentina. Años 1998, 1999, 2000, 2001, 2002, 2003 y 2004. Puppi, N; Ramírez, J. Dirección Nacional de Fiscalización Agroalimentaria. Abril.

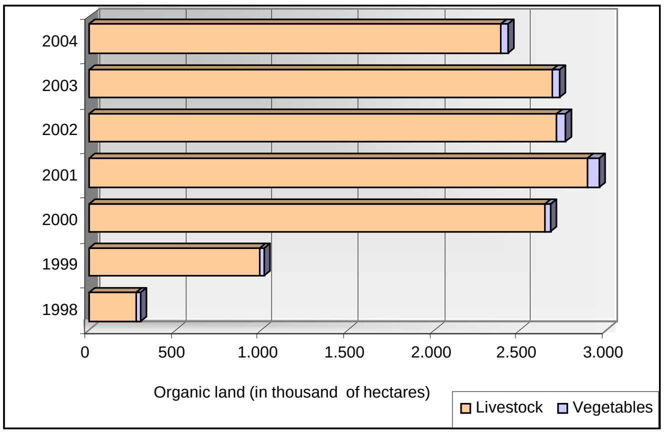
Table 1: Estimation results of the determinants of the number of links among producers

Variable	Coefficients	z-Statistic	Prob	Type	Mean	S.D.	Definitions
CUYOREG	-0.313	-1.62	0.105	D.V.	0.29		1 if the Region is Cuyo
NORTHENREG	0.168	0.58	0.564	D.V.	0.06		1 if the Region is North
PAMPREG	-0.280	-1.66	0.097	D.V.	0.39		1 if the Region is Pampean
QCHANNELS	0.316	3.98	0.000	C.V.	1.52	0.75	# of marketing channels
QPRODUCTS	-0.081	-1.50	0.133	C.V.	2.27	1.33	# of products
ALL PROD	0.410	2.73	0.006	D.V.	0.70		1 if the links involve whole products
GOVSUP	0.234	1.88	0.060	D.V.	0.55		1 if farm benefits from gov programs
PROCESS	0.993	7.47	0.000	D.V.	0.48		1 if farm does some processing product
IND. CROP	0.851	2.83	0.005	D.V.	0.16		1 if farm produces industrial crops
FRUITS & VEG	0.629	2.31	0.021	D.V.	0.57		1 if farm produces fruits and vegetables
CEREALS	0.789	2.86	0.004	D.V.	0.15		1 if farm produces cereals
AG PROF	-0.203	-1.32	0.188	D.V.	0.24		1 if manager is graduated in Ag Sciences
SMALLSIZE	-0.358	-1.38	0.166	D.V.	0.32		1 if farm area is less than 20 hectares
MEDSIZE	-0.487	-2.17	0.030	D.V.	0.48		1 if farm area is 1200 >hectares > 20
FAMILY LABOR	0.649	3.60	0.000	D.V.	0.14		1 if farm employs only family labor
FORMAL	0.419	3.20	0.001	D.V.	0.41		1 if farm is formal association member
AGE	-0.011	-1.71	0.087	C.V.	49.8	11.6	Age of the farm manager (years)
C	0.329	0.82	0.410				
QLINKS	Dependent Variable			Count	4.65	3.99	# of activities farm does linked to another farms
Log likelihood	-257.08116			LR index (Pseudo R^2)		0.1671	
Rest.L.likelihood	-311.27413						
LR (17 df)	103.15	$p > \chi^2 = 0.0000$		Note: D.V. indicates a dummy variable and C.V. a continuous variable			

Table 2: Results of the Tests for Selecting between the PRM, NBRM and ZINB

Test	Coefficient	Statistics	Prob
Wald (H_0: α= 0)	α=0.0879	t =1.9011	p > |t| = 0.059
LR (eq. 5)		$\chi^2 = 6.21$	p > |χ^2| = 0.006
Vuong		z = 1.58	p > |z| = 0.057

Figure 1: Organic land (in thousand of hectares) and quantities (in tons)



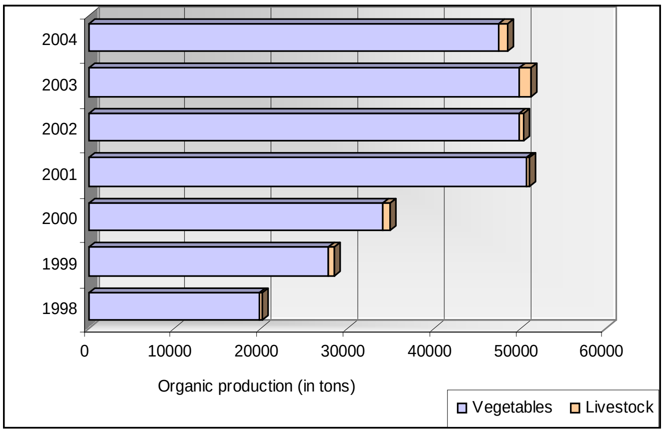
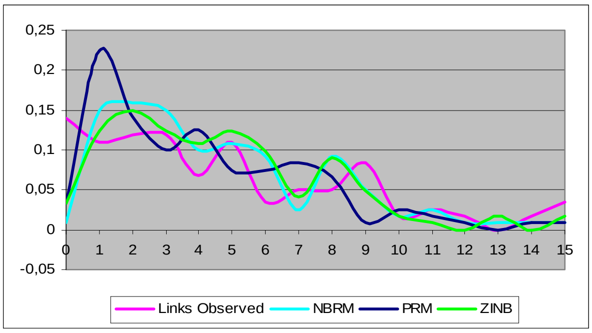


Figure 2. Links observed among producers and the estimations of the models



QLINKS					
Value	Count	Percent	Value	Count	Percent
0	17	14.41	8	6	5.08
1	13	11.02	9	10	8.47
2	14	11.86	10	2	1.69
3	14	11.86	11	3	2.54
4	8	6.78	12	2	1.69
5	13	11.02	13	0	0
6	4	3.39	14	2	1.69
7	6	5.08	15	4	3.39

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Authors

Introduction

……………………………………… ……………………………………… ………………………………………

I. Theoretical discussion

- Economies of scale ……………………………………… ………………………………………
- Market power ……………………………………… ………………………………………
- Risk and uncertainty ……………………………………… ………………………………………

II. Organic Sector in Argentina and Data

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Figure 1

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Figure 2

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III. Econometric Model and Empirical Results

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Table 1

Table 2

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Concluding Remarks

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