V CONGRESO de
EFICIENCIA Y PRODUCTIVIDAD
Córdoba, días 19 y 20 de Mayo 2011

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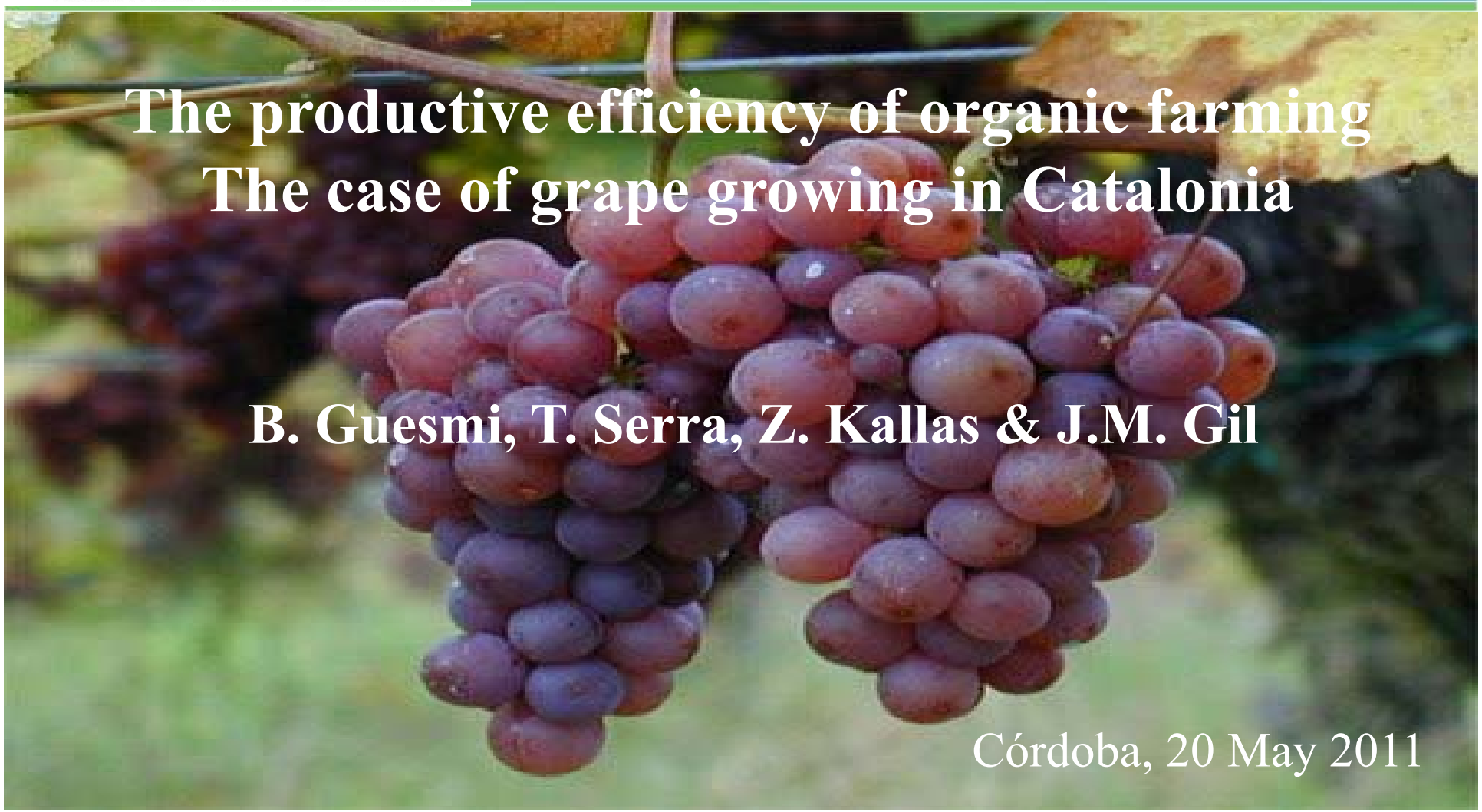

The productive efficiency of organic farming
The case of grape growing in Catalonia

B. Guesmi, T. Serra, Z. Kallas & J.M. Gil

Córdoba, 20 May 2011

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Motivation

- Relevant growth of organic farming in Spain and in Catalonia.
- Many of the farmers who converted after the late 1990s have been more driven by financial motives than by non-economic considerations (Padel, 2001; Rigby et al., 2001).
- Knowledge about productivity and efficiency differences between conventional and organic farms is important for different economic agents.
- Scarce literature on the performance of organic farming in Spain.

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Objectives

- Compare the efficiency ratings of organic and conventional grape farms in Catalonia.

- Determine the major factors that explain efficiency and the existing differences in efficiency between organic and conventional farms.

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Presentation Outline

- Organic farming
- Theoretical and econometric frameworks
- Data sources & Descriptive analysis
- Empirical framework & Results
- Concluding remarks

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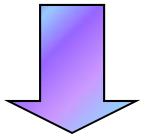
Organic farming

- Negative externalities derived from the intensive agricultural systems on human health, pollution of underground and surface water, loss of biodiversity, overutilization of natural resources.

- Social concerns about these negative externalities and an increase in consumer awareness of the consequences of shopping decisions on the environment in general and in particular on health.

- Changes in EU agricultural policies that have progressively introduced environmental considerations.



Organic farming as an alternative to conventional agricultural practices

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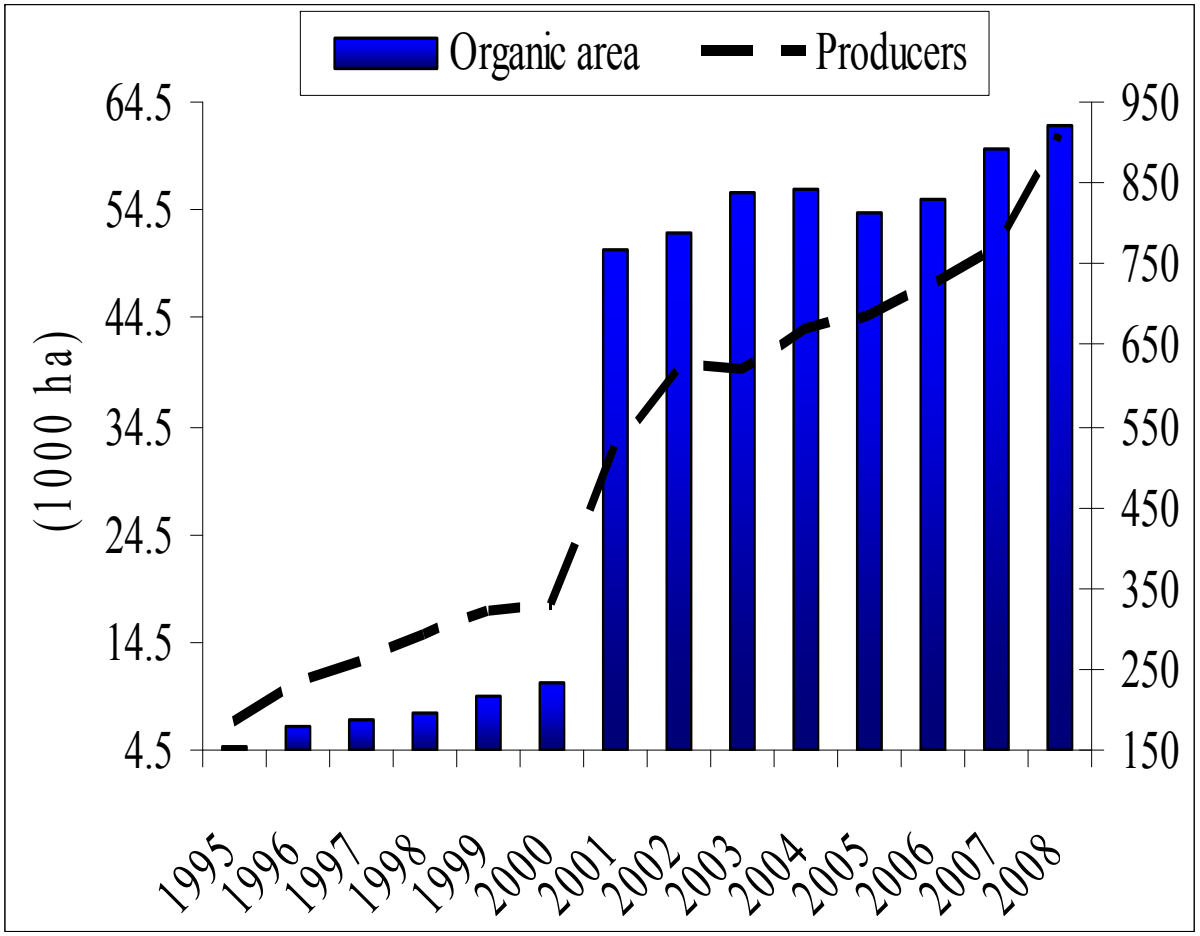
Organic farming in Catalonia



- ✓ Fourth in Spain (5%)
- ✓ Annual growth 37%
- ✓ 19% of the total Spanish organic food industry

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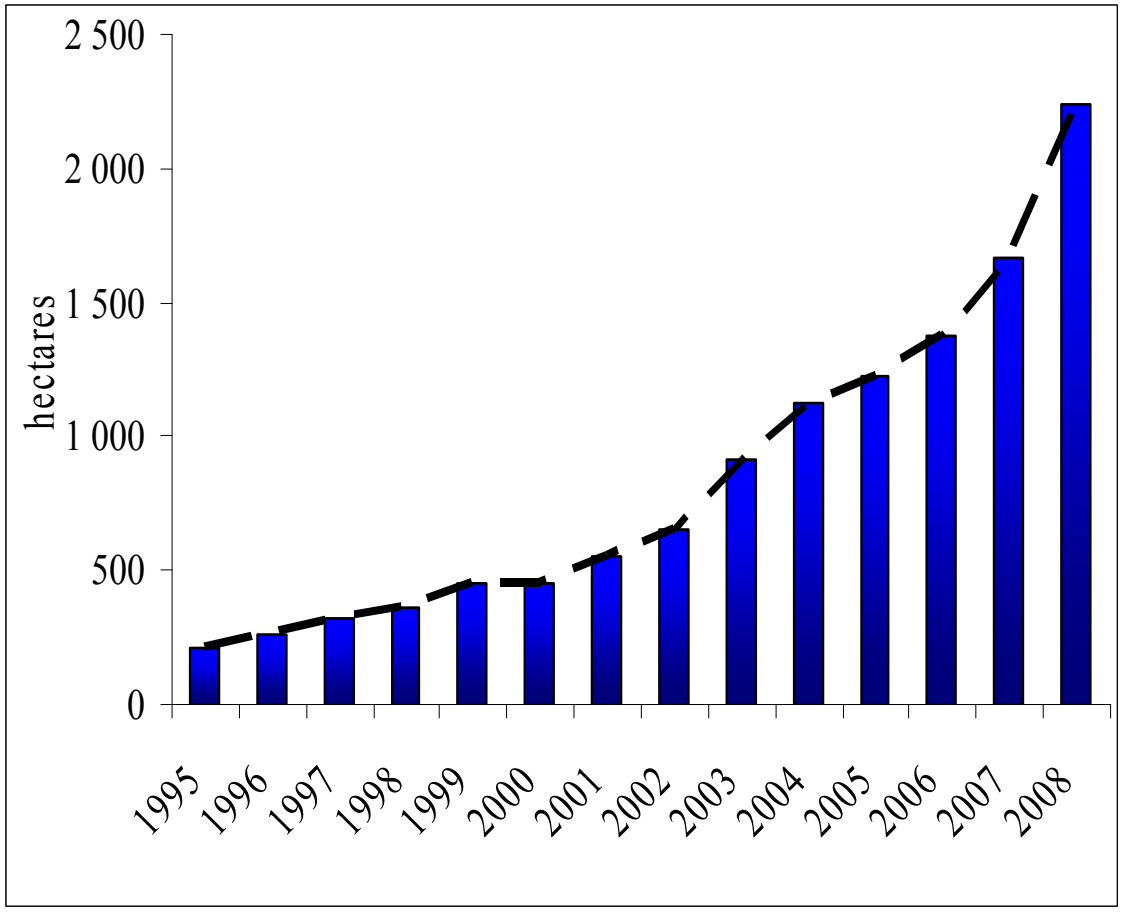
Evolution of Catalan organic vineyard



- ✓ 7 % of total organic area in Spain
- ✓ Annual growth 21%
- ✓ 3.6% of total Catalan organic area
- ✓ 2.65% of total vineyard area
- ✓ 7% of total spanish vineyard production

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Theoretical framework

- The general model (Aigner et al., 1977; Meeusen and Van den Broeck, 1977)

$$y_i = f(\mathbf{X}_i;\beta)\exp(e_i), e_i = v_i - u_i, \mathrm{i} = 1,2.....,\mathrm{N}$$

- The output oriented measure of TE

$$\mathrm{TE}_i = \frac{y_i}{f(\mathbf{X}_i;\beta)\exp(v_i)} = \exp(-u_i)$$

- The TE effects Model (Battese and Coelli, 1995)

$$u_i = \delta_0 + \sum_{m=1}^{M} \delta_m Z_{mi} + \varepsilon_i$$

- The log likelihood function

$$\ln L = \text{constant} - \frac{I}{2}\ln\left(\sigma_v^2 + \sigma_u^2\right) - \sum_i \ln\Phi\left(\frac{\mu_i}{\sigma_u}\right) + \sum_i \ln\Phi\left(\frac{\mu_i^*}{\sigma^*}\right) - \frac{1}{2}\sum_i \frac{\left(\varepsilon_i + \mu_i\right)^2}{\sigma_v^2 + \sigma_u^2}$$

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Data collection

- Data set

  - ✓ Cross sectional farm-level data
  - ✓ Region: Catalonia
  - ✓ Target sector: grape growing
  - ✓ Sample period: March-June 2008
  - ✓ Sample size: 141 farmers (26 organic, 115 conventional)

- Organic farmers were identified from the Official Certification Organism in Catalonia (CCPAE).

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Farm production, economics and management

Variable name	Unit of Measure	Organic		Conventional	
		Average	Std. dev	Average	Std. dev
Yield	Kg/ha	6,848	3,262	8,173	3,177
Revenue	€/ha	4,004	2,478	2,670	1,971
Total Revenue	€/ha	4,233	2,315	2,791	1,985
Labor	hours/ha	459	240	286	303
Machinery	N/ha	0.66	0.53	0.49	0.71
Other variable inputs	€/ha	860	752	835	1822
Fertilizers and crop protection	€/ha	381	579	294	399
Total cost	€/ha	1,814	1,422	1,508	1,923
Profit	€/ha	2,435	2,293	1,283	2,805

*mean values were calculated using farm-level data

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Empirical framework

- Our empirical model is specified as follows

$$\ln y_i = \left(\beta_0 + \beta_0^o\right) + \sum_{j=1}^{4}\left(\beta_j + \beta_j^o . D_{c/o}\right)\ln \mathbf{X}_{ji} + \frac{1}{2}\sum_{j=1}^{4}\sum_{k=1}^{4}\left(\beta_{jk} + \beta_{jk}^o . D_{c/o}\right)\ln \mathbf{X}_{ji} . \ln \mathbf{X}_{ki} + \left(v_i - u_i\right)$$

$$u_i = \delta_0 + \sum_{m=1}^{M} \delta_m \mathbf{Z}_{mi} + \varepsilon_i$$

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Hypothesis testing

Restrictions	**Model**	**λ**	$\chi^2_{0.95}$	**Decision**
$H_0 : \beta_{ij} = 0$	Cobb-Douglas	79.76	31.41	Reject
$H_0 : \delta^*_{jk} = 0$	Neutral Stochastic frontier	50.56	55.76	Accept
$H_0 : \gamma = \delta_m = 0$	No inefficiency effects	31.44	20.41	Reject
$H_0 : \gamma = 0$	No stochastic factor	90.27	5.14	Reject
$H_0 : \delta_m = 0$	No firm- specific factors	39.90	19.67	Reject

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Production and scale elasticities

- The output elasticity formula

$$\frac{\partial \ln E(Y)}{\partial \ln(x_k)} = \beta_k + 2\beta_{kk} X_{ki} + \sum_{j \neq k} \beta_{kj} X_{ji}$$

Elasticities with respect to	Conventional		Organic	
	Estimate	Standard-error	Estimate	Standard-error
Land area	0.558	0.024***	0.323	0.138**
Labor	0.041	0.026	0.075	0.003***
Capital	0.165	0.017***	0.323	0.024***
Fertilizer and crop protection	0.219	0.028***	0.686	0.083***
Return to scale	0.983		1.407	

Note: *** and ** indicate statistical significance at the 1%, 5%.

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Technical inefficiency effects model

Variable	Parameter	Estimate	Standard-error
Constant	δ_0	-0.523	0.941
Dc/o	δ_1	**-1.180**	0.315
Experience	δ_2	**-0.020**	0.010
Specialization	δ_3	-0.450	0.560
Farm is not located in less favored area	δ_4	**-0.534**	0.286
Credit	δ_5	0.035	0.248
Subsidy	δ_6	0.402	0.297
Family labor share	δ_7	**0.961**	0.513
Economic profit preferences	δ_8	0.007	0.260
Environmental preservation preferences	δ_9	**0.712**	0.285
Owned land	δ_{10}	-0.648	0.394
γ*	**0.99**		
Mean TE	**Organic: 0.80**		**Conventional : 0.64**

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Concluding Remarks

- This work investigates productivity and efficiency differences between conventional and organic grape in Catalonia.

- Organic farmers are technically more efficient than conventional farmers (80% vs. 64%).

- Organic farms are less productive (16% lower) and more profitable (90% higher) than conventional farms.

- We find that organic farms exhibit higher partial output elasticities for all inputs considered except land area.

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Concluding remarks

- Extensions

  - It would be useful to concentrate on the analysis of allocative efficiency, the second component of economic efficiency.

  - It would be useful to introduce other methodological innovations to assess efficiency, for example, local maximum likelihood estimation (Serra and Godwin, 2009) and dynamic frameworks (Rungsuriyawiboon and Stefanou, 2007; Tsionas, 2006).

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Thank you for your attention