Assessing Agricultural Policy Incentives for Greek Organic Agriculture: A Real Options Approach

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GREECE

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OBJECTIVES

To evaluate

Organic Dairy Sheep Farming

and

Current Support Measures

OBJECTIVES

- **Optimal investment trigger for a new comer into organic dairy sheep farming system**

- **The investment profitability of an existing organic farmer in his attempt to improve his farm**

SHEEP FARMING IN GREECE

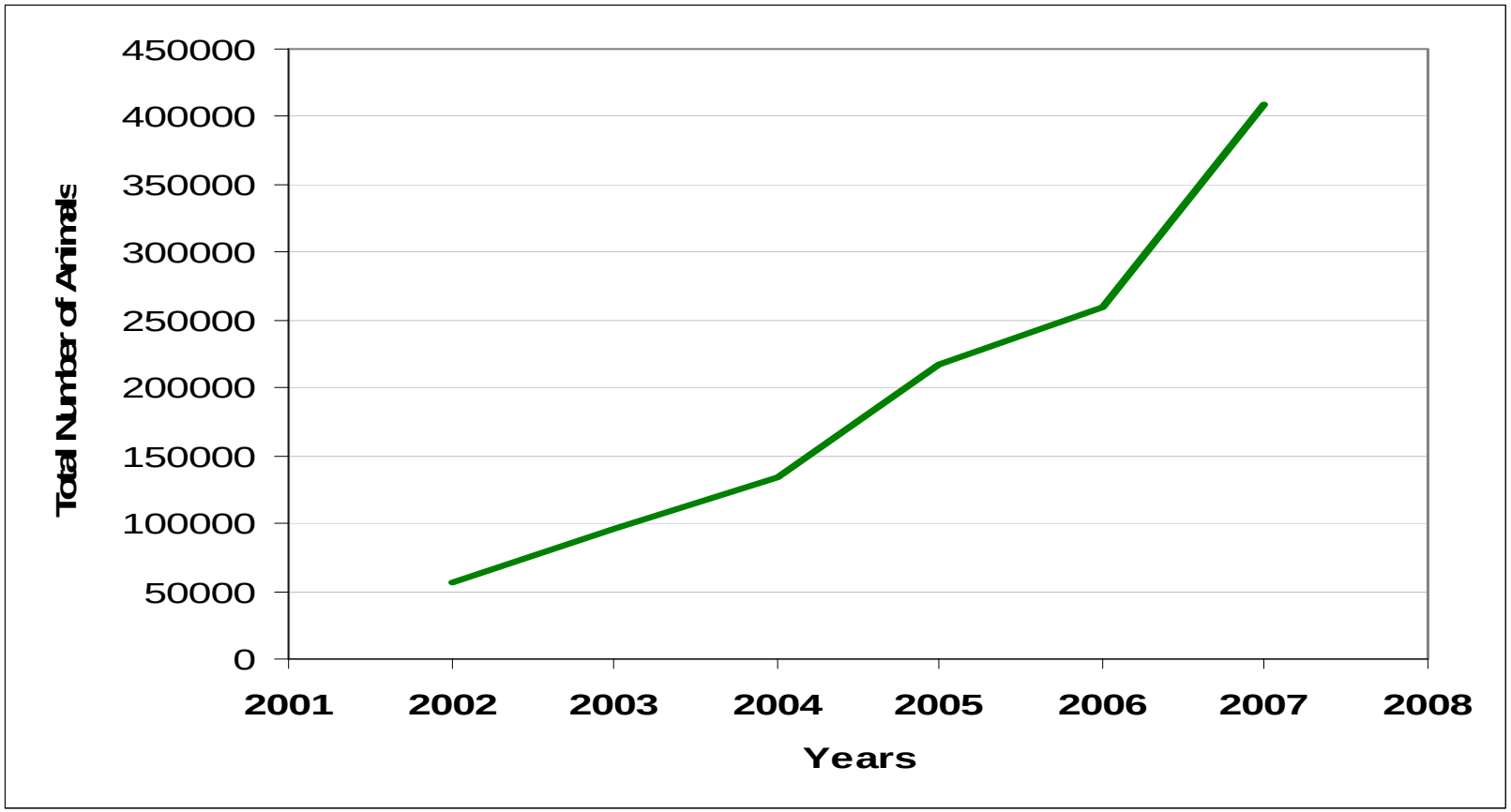
- 15% of the agricultural production
- 45% of the animal gross production
- The majority of farms:
  - Not intensive
  - Family farms
  - Isolated, less favorable areas

Organic Sheep Farming

- Appeared in 2000
- Great increase after 2002
- 2.9% of the total sheep production
- Several difficulties

Source: Hellenic Ministry of Rural Development and Food

Organic Sheep in Greece



Main Technical Characteristics of Greek Organic Sheep Farming

- Easy Conversion
- Inadequate Technical Support
- Breeding Strategies
- Feed Management
- Disease Control
- Small size of the farm
- Low educational level of farmers, Lack of skilled personnel

Main Economic Characteristics of Greek Organic Sheep Farming

- **Poor infrastructure, High Initial Investment Sunk Cost**
- **Uncertain Returns**
- **Low Price Premium**
- **Poorly Organized Marketing**
- **Financial Problems**

Opportunities For Greek Organic Dairy Sheep Farming

- **Organic label is a key for competitiveness towards dynamic changes in global environment**
- **Increased consumer demand for organic dairy products**
- **Increased consumer demand for Feta cheese PDO**

Opportunities For Greek Organic Dairy Sheep Farming

- **Measure for Organic Farming (239591/Oct 2009)**

- **Measure for Livestock "Small scale investment subsidy to modernize the sector" (Reg. 705/2008, 7931/June 2009)**

QUESTIONS OF GREEK INVESTORS SHEEP FARMERS

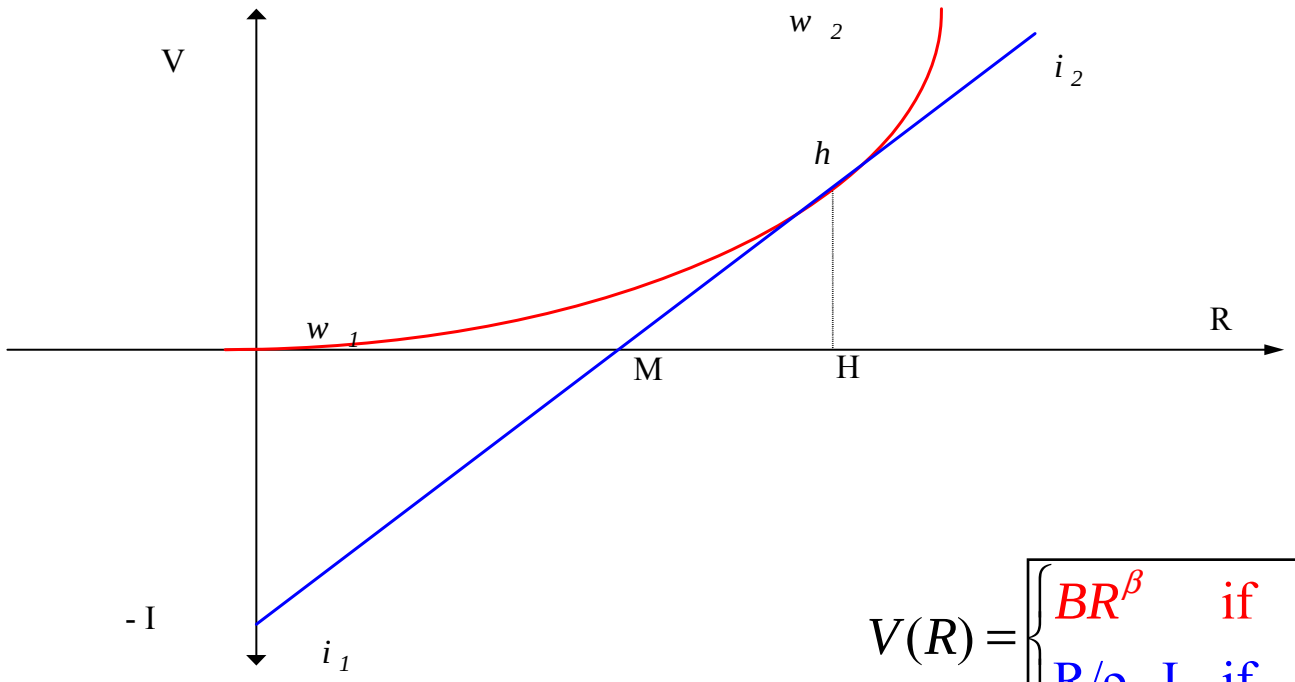
Should they invest on organic farming?

Are the current support measures attractive?

METHODOLOGY

NPV

Real Options



$$V(R) = \begin{cases} BR^{\beta} & \text{if} \quad R \le H \\ R/\rho - I & \text{if} \quad R \ge H \end{cases}$$

Optimal Investment Trigger (Dixit, 1992)

REAL OPTIONS APPROACH

$$\frac{dV}{V} = \mu\, dt + \sigma^2\, dz$$

V : **value of the opportunity to invest**

geometric *Brownian motion process*

μ : **mean**

σ^2 : **variance**

dz : increment of a Winner-Gauss process

OPTIMAL INVESTMENT TRIGGER

$$F(V) = \max E\left[(V_T - I)\, e^{-\rho T} \right]$$

$$H = I + F(V)$$

Source : "Investment Under Uncertainty", Dixit & Pindyck, 1994

OPTIMAL INVESTMENT TRIGGER

$$H = \frac{\beta}{\beta - 1} \rho \, I$$

$$\beta = \frac{1}{2}\left[1 + \sqrt{1 + \frac{8\rho}{\sigma^2}}\right] \succ 1$$

Source : "Investment Under Uncertainty", Dixit & Pindyck, 1994

DETERMINANT PARAMETERS

- **Annual Expected Returns of the investment (R)**
- **Sunk Cost of initiating the investment project (I)**
- **Risk-adjusted discount rate (ρ)**
- **Mean of log of the value of the opportunity to invest (μ)**
- **Variance of log of the value of the opportunity to invest (σ^2)**

SIMULATIONS

$$NPV_t = \sum_{i=0}^{n} \frac{R_{t+i}}{(1+\rho)^i}$$

$$NPV_{t+1} = \sum_{i=1}^{n+1} \frac{R_{t+i}}{(1+\rho)^{i-1}}$$

$$V_t = \frac{\left[\frac{\rho}{1-\left(\frac{1}{(1+\rho)^{n-t}}\right)} NPV_t\right]}{\rho}$$

$$V_{t+1} = \frac{\left[\frac{\rho}{1-\left(\frac{1}{(1+\rho)^{n-t-1}}\right)} NPV_{t+1}\right]}{\rho}$$

$$\Delta(\ln V_j) \equiv \ln(V_t) - \ln(V_{t+1})$$

SIMULATIONS

$$\mu_V \approx \frac{1}{N}\sum_{j=1}^{N}[\Delta \ln V_j]$$

$$\sigma_V^2 \approx \frac{1}{N}\sum_{j=1}^{N}[\Delta \ln V_j - \mu_V]^2$$

DATA

- Face to face interviews: 34 conventional and 16 organic farms in the region of Macedonia
- FADN: 22 dairy farms
  - Conventional milk yield
  - Conventional milk price
- Expert knowledge
  - Organic milk yield
  - Organic milk price
- Literature

OPTIONS

	SCENARIOS
Existing organic	Basic Scenario
New comer	Scenario Chickpea
Existing conventional	Scenario +30% alfalfa
	Scenario -30% alfalfa

DATA

Sunk cost

Initial Investment Cost

-Buildings
-Equipment
-Animal Capital

Improvement Cost

-Buildings
-Milking Machine
-

Annual Operating Cost of the Flock for Organic and Conventional Sheep Farming

	Organic				Conventional		
	Basic	Chick pea	-30% alfalfa	+30% alfalfa	Basic	-30% alfalfa	+30% alfalfa
Land	5.41	5.41	5.41	5.41	2.76	2.76	2.76
Labour	39.81	39.81	39.81	39.81	37.12	37.12	37.12
Variable Cost	62.80	62.88	66.67	59.74	101.06	107.20	95.77
Feed Cost	58.74	58.82	62.54	55.74	98.95	104.96	93.80
Purchased Hay	17.53	17.53	20.76	13.09	18.73	25.38	15.75
Purchased Corn	9.30	9.30	9.3	9.3	10.18	10.18	10.18
Other Purchased Concentrates	2.27	-	2.27	2.27	22.26	22.26	22.26
Produced Grains	7.89	10.24	7.89	7.89	19.86	19.86	19.86
Produced Hay	12.66	12.66	13.23	14.1	17.27	16.63	13.13
Salt Mineral	0.44	0.44	0.44	0.44	2.00	2.00	2.00
Other, Certification, etc	12.71	12.71	12.78	12.65	10.76	10.89	10.62
TOTAL OPERATING COST	108.0	108.1	111.9	104.9	140.9	147.0	135.65

Statistics for Simulated and Detrended Historical Data for conventional farming

	Milk Yield		Milk Price		Meat Price
	Simulated	Detrended Historical	Simulated	Detrended Historical	Simulated
Mean	121.50	121.54	0.86	0.86	4.03
StDev	12.38	11.46	0.02	0.02	0.41
CV	10.19	9.43	2.56	2.57	10.14
Min	77.87	93.19	0.78	0.79	3.02
Max	160.70	158.24	0.93	0.91	4.98
Tests of simulated means vs observed means*					
	Test Value	Critical Value	Test Value	Critical Value	
2 Sample t Test**	-0.04	2.27**	0.01	2.27**	
F Test***	1.17	1.28***	1.01	1.25***	

Statistics for Simulated Yield and Price for Organic Farming

	Milk Yield	Milk Price	Meat Price
Mean	84.4	0.91	4.50
Min	50	0.75	3.50
Max	135	1.10	5.50

RESULTS

Modified Hurdle Rate ρ'

BASIC SCENARIO	New comer	Existing organic	Existing conventional
Without Organic & Investment subsidies	13.97%	15.85%	-
With Organic Subsidies & NO Investment subsidies	12.29%	12.98%	12.66%
With Organic & Investment subsidies	12.29%	12.98%	12.66%

RESULTS

β/β-1

BASIC SCENARIO	New comer	Existing organic	Existing conventional
Without Organic & Investment subsidies	1.9816	1.7461	-
With Organic Subsidies & NO Investment subsidies	1.6220	1.5358	1.5828
With Organic & Investment subsidies	1.6220	1.5358	1.5828

RESULTS

New Comer

	Without Organic & Investment subsidies	With Organic Subsidies & NO Investment subsidies	With Organic & Investment subsidies
Basic	H >E(R)	H >E(R)	H >E(R)
Chickpea	H >E(R)	H >E(R)	H >E(R)
+30% alfalfa	H >E(R)	H >E(R)	H >E(R)
-30% alfalfa	H >E(R)	H >E(R)	H >E(R)

RESULTS

Existing Organic Dairy Sheep farmer

	Without Organic & Investment subsidies	With Organic Subsidies & NO Investment subsidies	With Organic & Investment subsidies
Basic	H >E(R)	H <E(R)	H <E(R)
Chickpea	H >E(R)	H <E(R)	H <E(R)
+30% alfalfa	H >E(R)	H <E(R)	H <E(R)
-30% alfalfa	H >E(R)	H <E(R)	H <E(R)

RESULTS

Existing Conventional Dairy Sheep farmer

	NO Investment subsidies	WITH Investment subsidies
Basic	H >E(R) ?	H <E(R)
+30% alfalfa	H >E(R) ?	H <E(R)
-30% alfalfa	H >E(R) ?	H <E(R)

CONCLUSIONS

Risk and uncertainty are important factors for organic dairy sheep farmers

The current economic incentives for organic dairy sheep yield positive economic results

Organic subsidies are crucial for the development of the sector

CONCLUSIONS

The development strategy for organic Greek sheep farming is on the right way

Investment on New Organic sheep farming remains an option that has to be kept alive

Existing organic farmers have to apply for small scale improvement plans

CONCLUSIONS

The potential returns from conventional dairy sheep farming are not high enough to offset the relevant risk and uncertainty

Existing conventional farmers have to apply for small scale improvement plans to modernize the farm

Thank you for your attention!

ΕΘΙΑΓΕ
ΕΘΝΙΚΟ ΙΔΡΥΜΑ
ΑΓΡΟΤΙΚΗΣ ΕΡΕΥΝΑΣ