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

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GREECE
CONTENTS

- Objectives
- Methodology
- Data description
  - Cost of production budgets
  - Yield data
  - Price data
- Analysis and Results
- Concluding remarks
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

Years

Total Number of Animals

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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
Optimal Investment Trigger (Dixit, 1992)

\[ V(R) = \begin{cases} 
BR^\beta & \text{if } R \leq H \\
R/\rho - I & \text{if } R \geq H 
\end{cases} \]
REAL OPTIONS APPROACH

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

- \( V \): value of the opportunity to invest
  geometric Brownian motion process
- \( \mu \): mean
- \( \sigma^2 \): variance
- \( dz \): increment of a Winner-Gauss process

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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

\[ H = \frac{\beta}{\beta - 1} \rho \ I \]

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

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 (σ²)
**Simulations**

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

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

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

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

\[ \Delta (\ln V_j) \equiv \ln(\ V_t ) - \ln(\ V_{t+1} ) \]
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
New comer
Existing conventional

Basic Scenario
Scenario Chickpea
Scenario +30% alfalfa
Scenario -30% alfalfa
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

<table>
<thead>
<tr>
<th></th>
<th>Organic</th>
<th></th>
<th></th>
<th>Conventional</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Basic</td>
<td>Chick pea</td>
<td>-30% alfalfa</td>
<td>+30% alfalfa</td>
<td>Basic</td>
<td>-30% alfalfa</td>
</tr>
<tr>
<td><strong>Land</strong></td>
<td>5.41</td>
<td>5.41</td>
<td>5.41</td>
<td>5.41</td>
<td>2.76</td>
<td>2.76</td>
</tr>
<tr>
<td><strong>Labour</strong></td>
<td>39.81</td>
<td>39.81</td>
<td>39.81</td>
<td>39.81</td>
<td>37.12</td>
<td>37.12</td>
</tr>
<tr>
<td><strong>Variable Cost</strong></td>
<td>62.80</td>
<td>62.88</td>
<td>66.67</td>
<td>59.74</td>
<td>101.06</td>
<td>107.20</td>
</tr>
<tr>
<td><strong>Feed Cost</strong></td>
<td>58.74</td>
<td>58.82</td>
<td>62.54</td>
<td>55.74</td>
<td>98.95</td>
<td>104.96</td>
</tr>
<tr>
<td>Purchased Hay</td>
<td>17.53</td>
<td>17.53</td>
<td>20.76</td>
<td>13.09</td>
<td>18.73</td>
<td>25.38</td>
</tr>
<tr>
<td>Purchased Corn</td>
<td>9.30</td>
<td>9.30</td>
<td>9.3</td>
<td>9.3</td>
<td>10.18</td>
<td>10.18</td>
</tr>
<tr>
<td>Other Purchased Concentrates</td>
<td>2.27</td>
<td>-</td>
<td>2.27</td>
<td>2.27</td>
<td>22.26</td>
<td>22.26</td>
</tr>
<tr>
<td>Produced Grains</td>
<td>7.89</td>
<td>10.24</td>
<td>7.89</td>
<td>7.89</td>
<td>19.86</td>
<td>19.86</td>
</tr>
<tr>
<td>Salt Mineral</td>
<td>0.44</td>
<td>0.44</td>
<td>0.44</td>
<td>0.44</td>
<td>2.00</td>
<td>2.00</td>
</tr>
<tr>
<td>Other, Certification, etc</td>
<td>12.71</td>
<td>12.71</td>
<td>12.78</td>
<td>12.65</td>
<td>10.76</td>
<td>10.89</td>
</tr>
<tr>
<td><strong>TOTAL OPERATING COST</strong></td>
<td>108.0</td>
<td>108.1</td>
<td>111.9</td>
<td>104.9</td>
<td>140.9</td>
<td>147.0</td>
</tr>
</tbody>
</table>
# Statistics for Simulated and Detrended Historical Data for conventional farming

<table>
<thead>
<tr>
<th></th>
<th>Milk Yield</th>
<th>Milk Price</th>
<th>Meat Price</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Simulated</td>
<td>Detrended</td>
<td>Simulated</td>
</tr>
<tr>
<td>Mean</td>
<td>121.50</td>
<td>121.54</td>
<td>0.86</td>
</tr>
<tr>
<td>StDev</td>
<td>12.38</td>
<td>11.46</td>
<td>0.02</td>
</tr>
<tr>
<td>CV</td>
<td>10.19</td>
<td>9.43</td>
<td>2.56</td>
</tr>
<tr>
<td>Min</td>
<td>77.87</td>
<td>93.19</td>
<td>0.78</td>
</tr>
<tr>
<td>Max</td>
<td>160.70</td>
<td>158.24</td>
<td>0.93</td>
</tr>
</tbody>
</table>

Tests of simulated means vs observed means:

<table>
<thead>
<tr>
<th>Test Type</th>
<th>Test Value</th>
<th>Critical Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>2 Sample t Test**</td>
<td>-0.04</td>
<td>2.27**</td>
</tr>
<tr>
<td>F Test***</td>
<td>1.17</td>
<td>1.28***</td>
</tr>
</tbody>
</table>

Note: *Critical values are based on a significance level of 0.05.

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Statistics for Simulated Yield and Price for Organic Farming

<table>
<thead>
<tr>
<th></th>
<th>Milk Yield</th>
<th>Milk Price</th>
<th>Meat Price</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Mean</strong></td>
<td>84.4</td>
<td>0.91</td>
<td>4.50</td>
</tr>
<tr>
<td><strong>Min</strong></td>
<td>50</td>
<td>0.75</td>
<td>3.50</td>
</tr>
<tr>
<td><strong>Max</strong></td>
<td>135</td>
<td>1.10</td>
<td>5.50</td>
</tr>
</tbody>
</table>
## RESULTS

**Modified Hurdle Rate** $\rho'$

<table>
<thead>
<tr>
<th>BASIC SCENARIO</th>
<th>New comer</th>
<th>Existing organic</th>
<th>Existing conventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without Organic &amp; Investment subsidies</td>
<td>13.97%</td>
<td>15.85%</td>
<td>-</td>
</tr>
<tr>
<td>With Organic Subsidies &amp; NO Investment subsidies</td>
<td>12.29%</td>
<td>12.98%</td>
<td>12.66%</td>
</tr>
<tr>
<td>With Organic &amp; Investment subsidies</td>
<td>12.29%</td>
<td>12.98%</td>
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## RESULTS

### $\beta/\beta-1$

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<th>New comer</th>
<th>Existing organic</th>
<th>Existing conventional</th>
</tr>
</thead>
<tbody>
<tr>
<td>Without Organic &amp; Investment subsidies</td>
<td>1.9816</td>
<td>1.7461</td>
<td>-</td>
</tr>
<tr>
<td>With Organic Subsidies &amp; NO Investment subsidies</td>
<td>1.6220</td>
<td>1.5358</td>
<td>1.5828</td>
</tr>
<tr>
<td>With Organic &amp; Investment subsidies</td>
<td>1.6220</td>
<td>1.5358</td>
<td>1.5828</td>
</tr>
</tbody>
</table>
# RESULTS

## New Comer

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<thead>
<tr>
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<th>Without Organic &amp; Investment subsidies</th>
<th>With Organic Subsidies &amp; NO Investment subsidies</th>
<th>With Organic &amp; Investment subsidies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic</strong></td>
<td>H &gt; E(R)</td>
<td>H &gt; E(R)</td>
<td>H &gt; E(R)</td>
</tr>
<tr>
<td><strong>Chickpea</strong></td>
<td>H &gt; E(R)</td>
<td>H &gt; E(R)</td>
<td>H &gt; E(R)</td>
</tr>
<tr>
<td>+30% alfalfa</td>
<td>H &gt; E(R)</td>
<td>H &gt; E(R)</td>
<td>H &gt; E(R)</td>
</tr>
<tr>
<td>-30% alfalfa</td>
<td>H &gt; E(R)</td>
<td>H &gt; E(R)</td>
<td>H &gt; E(R)</td>
</tr>
</tbody>
</table>
## Results

### Existing Organic Dairy Sheep farmer

<table>
<thead>
<tr>
<th></th>
<th>Without Organic &amp; Investment subsidies</th>
<th>With Organic Subsidies &amp; NO Investment subsidies</th>
<th>With Organic &amp; Investment subsidies</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Basic</strong></td>
<td>H &gt;E(R)</td>
<td>H &lt;E(R)</td>
<td>H &lt;E(R)</td>
</tr>
<tr>
<td><strong>Chickpea</strong></td>
<td>H &gt;E(R)</td>
<td>H &lt;E(R)</td>
<td>H &lt;E(R)</td>
</tr>
<tr>
<td><strong>+30% alfalfa</strong></td>
<td>H &gt;E(R)</td>
<td>H &lt;E(R)</td>
<td>H &lt;E(R)</td>
</tr>
<tr>
<td><strong>-30% alfalfa</strong></td>
<td>H &gt;E(R)</td>
<td>H &lt;E(R)</td>
<td>H &lt;E(R)</td>
</tr>
</tbody>
</table>

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# RESULTS

Existing Conventional Dairy Sheep farmer

<table>
<thead>
<tr>
<th></th>
<th>NO Investment subsidies</th>
<th>WITH Investment subsidies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Basic</td>
<td>$H &gt; E(R)$ ?</td>
<td>$H &lt; E(R)$</td>
</tr>
<tr>
<td>+30% alfalfa</td>
<td>$H &gt; E(R)$ ?</td>
<td>$H &lt; E(R)$</td>
</tr>
<tr>
<td>-30% alfalfa</td>
<td>$H &gt; E(R)$ ?</td>
<td>$H &lt; E(R)$</td>
</tr>
</tbody>
</table>
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!