The role of micro-economic models for policy impact assessment - the MEA-Scope experience

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EU Agricultural policy to be defended in WTO negotiations

Concept of MFA arises and becomes part of EU policy (EEAC, 2000)

NCO became a major argument for support of farmers

Policy impact assessment is part of the EU policy strategy (SEC, 2004)

=> Social, economic and ecological impacts
Sustainability impact assessment of policies

- Ex post: evaluation of existing policies
- Ex ante: evaluation of future policies

Questions

- Effectiveness
  - Policy uptake & goal attainment
- Efficiency
  - Best attainment with least means
- Short/long term economic effects
- Short/long term environmental effects
- Short/long term social effects
Social and economic impacts depend on type and size of farms and in the long run on the consequences on structural change.

Ecological impacts strongly depend on local conditions:

- soil, climate, existing flora and fauna and related natural habitats

Therefore individual farms and their behavior are important.

- Microeconomic models may allow simulation of large numbers of different conditions.
- Bio-physical impacts can be modeled on the basis of simulated land use change.
Micro-economic farm models

Farm capacities – production options - interrelations

Calibration procedures

Land use change

Environmental impacts of land use change

Exogenous:

Policies: incentives, command & control, moral suasion

prices

technologies

Scenarios

Spatial link

Direct or Indirect

Temporal

dynamic or static

Berlin, April 7th, 2008
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Micro economic models encompass a large range of different modeling approaches from partial equilibrium models to agent based and mathematical programming farm models.
Exogenous:

- Prices
- Technologies

Policies: incentives, command & control, moral suasion

Scenarios

Expert based rules evaluate activities for 14 env. indicators

Micro-economic farm models

Direct or Indirect

Spatial link

Farm capacities – production options - interrelations

Land use change

Environmental impacts of land use change

Temporal dynamic or static

=> Trade-off functions
Exogenous:

Policies: incentives, command & control, moral suasion

prices

scenarios

technologies
FSSIM-AM & APES

soils
weather

alternative activities

Micro-econimic farm models
Farm capacities – production options - interrelations

Calibration by PMP

Spatial link
Direct or Indirect

Temporal
dynamic or static

Land use change

↓↓↓

Environmental impacts of land use change
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IAMO - Agripolis multi-agent system

Exogenous:

Prices

Technologies

Policies: incentives, command & control, moral suasion

Scenarios

Land use change

Environmental impacts of land use change

Spatial link

Direct or Indirect

Temporal dynamic or static

Rentability

Micro-economic farm models

Farm capacities – production options - interrelations

Feedback loop

Land market

A representation of all farms in the region
MEAScope Modelling Approach - overview

1. Data collection
   - IAMO: farm structure and typology from IACS / FADN data
   - ZALF: production activities
   - DIAS: geographical, soil and climate data

2. Regionalisation:
   - site and farm typology
   - (DFG & IAMO)

3. AgriPoliS (IAMO)
   - dynamic agent based agricultural structure model
   - based on spatial distribution of farms
   - simulates land market
   - simulation with $\Delta t = 1$ year
   - structural change
   - Interface farm structure

4. MODAM (ZALF)
   - simulation of typical farms (LP)
   - detailed production activities and sites
   - impacts for species and habitats
   - trade offs between different objectives
   - analysis of policy instruments
   - Interface land use structure

5. FASSET/Farm-N (DJF)
   - soil and water matter flows at field level
   - generation of crop rotations
   - simulation with $\Delta t = 1$ day

6. Visualisation of results

Environmental Indicators
- groundwater recharge
- nitrate leaching
- biodiversity
- species (4)
- erosion (2)
- nitrate leaching
- greenhouse gases
- energy consumption

Interface
farm structure

Interface
land use structure

$0 \quad t=0 \quad t=5 \quad t=1 \quad t=15 \quad ...$
Regions react specifically

- Decoupling slowed down structural change (more farms remain in production) while extensive beef producing farms disappear

- Cross compliance effect (less abandoned grassland area, more grassland under basic management – beneficial for most indicators)

Details of results: see

- Sandra Uthes (Monday) and
- Annette Piorr (Wednesday)
- Fabrizio Ungaro (Tuesday)
- Website: [www.mea-scope.eu](http://www.meascope.eu)

- The MEA-Scope modeling approach is suitable to analyze impacts of agro-environmental policies at a regional level
### Choices in application of microeconomic models for sustainability policy assessment

A crucial point of micro-economic models is the level of detail that determines the practicability of the approach, the quality of results and problem specific.

<table>
<thead>
<tr>
<th>small scale and short term SIA</th>
<th>large scale and long term SIA</th>
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#### Detail of data and detail of models

- **Farms**
  - individual farm
  - Preferences, management skills
  - Resources of average farms
  - pure economic rationality

- **Production activities**
  - Detailed economic characteristics
  - work steps
  - averages per crop
  - undifferentiated management
  - By soil type and weather
  - generated as in FSSIM
  - agro-environmental zone

- **Environmental indicators**
  - detailed status of environment
  - mechanistic models
  - zonations of soil and climate
  - expert based rules

- **Data and models**
  - Validation and calibration
  - management of quality
The role of microeconomic models for sustainability impact assessment of policies

- Large scale and long term PIA has to work with
  - Farm types
  - Average activities
  - Rough assessment of biophysical indicators

- Therefore, micro-economic and bio-physical analysis in the context of case studies can add important knowledge on
  - structural change
  - winners and losers
  - environmental impact of specific production activities
  - …
Thank you!