Structural Change and Policy Impact Modelling

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Challenge

- Agricultural policy impact on farm structure is a highly desired type of information

- Will the next EU reform step change the dynamics of structural adjustment?

- How much, where, and for what type of farms is relevant to stakeholders and decision makers

- Obviously, the larger the reform step, the more important this information (e.g. abandoning or strongly reducing direct payments)

We do not live up to the challenge (yet?)

- Empirical knowledge on the relevant processes governing farm structural change is fragmented for methodological and data reasons

- Validity of conceptually suitable simulation tools not sufficiently established and complexity inhibits application with policy relevant coverage

- Currently used ex-ante assessment tools at sectoral level are not ready to endogenously model structural change

→ Somewhat meaningful ex-ante impact projections with sectoral scope and market feedbacks currently not available

Outline

- **Empirical approaches and generated knowledge**
- Recent experimental advances
- Ongoing and potential cross fertilisation
- Directions for policy impact modelling
- Conclusions

Empirical knowledge

- Zimmermann et al. 2009 provide recent survey on statistical approaches

- Background objective is to identify tools and determinants of farm structural change relevant for sectoral level analyses covering EU

- No unified theory on farm structural change seems to exist, but theory suggest a set of relevant determinants for growth, exit/entry, specialisation...

Determinants
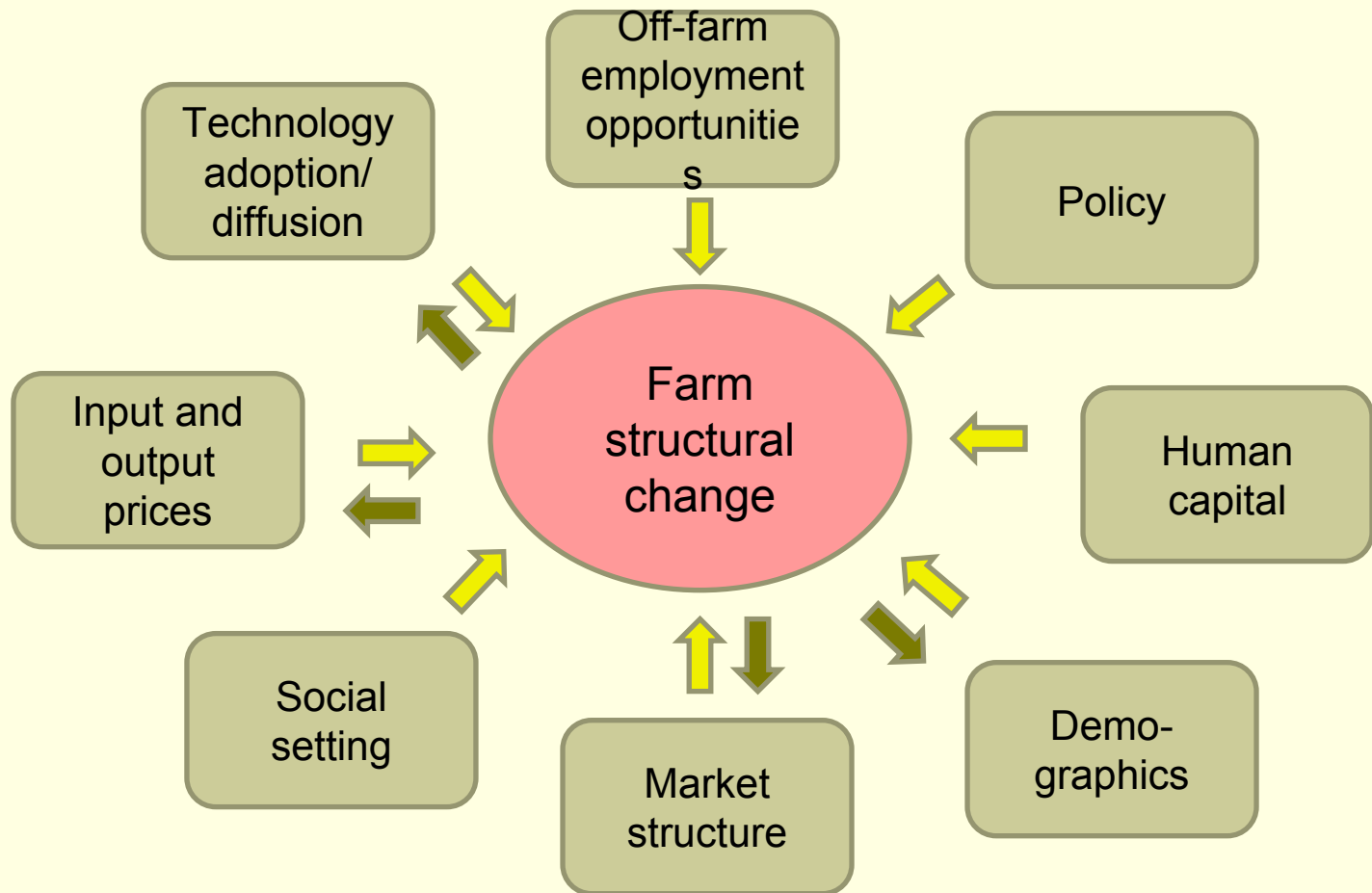
Models on farm growth, no. of farm holders, succession, exit

- Identify relevance of socio-demographic variables
- Conditions outside of agriculture rarely significant or not even considered
- Dimension of structural change limited
- Regional coverage restricted
- The few cross regional studies on exit rates identify significant impact of policies (e.g. Breustedt and Glauben 2007)

Markov chain models

- Widely used for 40 years: conceptually allow to model changes in distributions of farm size and production orientation

- But existing studies restricted to farm size distribution of all farms or within one specialisation

- Limited to one or a very small number of regions

- Consequently, only determinants relevant for time variation in structural change are usually identified:
  - Technological change, policy reforms, movement in output and input prices

General caveats

- Complexity of structural change processes likely imply varying parameters over time and space (Margarian 2007)

- Current statistical models identify correlations, but provide very little insight into underlying processes

- Influence of many potential determinants cannot be well detected due to lack of variation (limited scope)

- The way we *measure* policies very important for identified impact (e.g. cross regional variation of direct payments measures much more than the size of the subsidy)

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Experimental advances

- Agent based modelling (ABM) recently provides exciting alternative to model farm structural change (e.g. Balmann 1997; Happe 2004; Happe et al. 2008)

- Explicit representation of interaction between agents within an environment

- Allows to flexibly study the underlying processes of farm structural change in a laboratory fashion

- Able to derive hypotheses without immediate need for complete underlying data

What have we already learned

ABMs with focus on structural change already made us aware what else is all relevant:

- Initial structure (path dependency)
- Heterogeneity: in farm size, specialisation, productivity, production conditions...
- Policy specifics: exact implementation of premium schemes
- Spatial competition structures
- Market clearing mechanisms
- Land tenure system
- ...

Current limits of ABMs

- Complexity: restricted to case studies or few regions (and as long as we don't know what is all relevant, we cannot sample in a representative fashion....)

- Black box problem harming acceptance of results

- State of validation based on observed developments is not sufficient for developing trust in ex-ante projections

- Considerable technical investments necessary to do relevant research with ABMs

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Cross fertilisation already occured

- Cross-regional Markov chain analyses on changes in farm size distribution/specialisation start to appear (Huettel & Margarian 2009; Zimmermann & Heckelei 2008, 2010a&b)

- Allows to include new variables and better detect significance: initial structure, heterogeneity, age structures, unemployment rates, natural resource endowments...

- New methodological/data developments support applications with larger scope: access to micro data with observed transitions, two step procedures (Stokes 2006), combination of micro and macro data...

Potential to move on

- **Database development**
  - Little has happened yet in carefully measuring and incorporating policies (differences in premium schemes, land market institutions, RD-measures ...)
  - Developing measures relevant for spatial competition (building upon Huettel & Margarian 2009)
- **Statistical validation of ABMs**
  - Better statistical models allow to test hypotheses derived by ABMs
  - Statistical meta models of ABMs could be compared with similarly structured models based on observed behaviour (expanding on initial approaches by Happe 2004)
- **Can reduction of existing ABMs to relevant mechanisms allow an application with larger scope in the medium term?**

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Avenues for policy impact modelling (with market feedbacks)

- Agricultural sector models with endogenous structural change regarding size and specialisation are rare)
- Exception: DREMFIA (e.g. Lehtonen et al. 2007)
  - Activity based spatial price equilibrium model
  - Technology diffusion and investment model for dairy drives farm structure
  - Calibration to existing farm structure possible
- Exception: FAMOS (Weiss, F. 2007)
  - Representative farm type model
  - Farm type weights are updated based on estimation results on exit and switching farm types

Possibilities at EU-level

- CAPRI model "one system approach"
  - farm type layer at NUTS2 in EU-27 (~3000 models) based on FSS and FADN (Gocht 2009)
  - Similar to FAMOS, the vision is to update weights of farm types based on exog. and endog. model variables
  - Empirical foundation would be ideally suitable EU wide Markov approach
- Linking in loose fashion
  - PE market model scenarios define economic framework conditions
  - Plugged into farm type models with adjustment of weights
  - Feedback to market is missing, but realisable with moderate technical effort

Conclusions

- Modelling policy impact on farm structural change at a representative level currently not available

- The empirical knowledge of these policy impacts is fragmented and stable characteristics of processes underlying farm structural change missing

- ABMs are promising as a tool but suffer from insufficient validation and complexity

- Advances occur and are expected to increase by letting ABMs and statistical models benefit each other

- Concepts to model structural change at sectoral level with EU coverage available, but waiting for a better empirical foundation