Toward a multiple outcome impact assessment of research in agriculture

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outline

• Impresa – Research question
• Background
• Paper objectives
• Proposed methodology
• Preliminary results
• Discussion
Research questions - Task 4.2

• General objective of T4.2 (Unipi Task leader)
  – What is the adjusted impact of agricultural research expenditure taking into account both research objectives and sustainability of agricultural systems

• Specific objectives
  – How to estimate multiple impacts of agricultural research expenditure?
  – How to evaluate research priorities /objectives over time?
  – How to measure and incorporate environmental and social dimensions on the estimation of research expenditure impacts?
Background (1)

- Large literature deals with estimation of research impact on productivity measure (see Alston et al. 2000; Alston et al., 2011; Pardey et al., 2012)
- Several papers investigate limits of productivity in measuring sustainability of agricultural systems (Byerlee and Murgai and 2001)
  - TFP does not take into account non-market outputs and inputs (positive and negative externalities) Repetto et al., 1996; 1997;
  - Research on Agriculture does not pursue only productivities objectives (Richards 2004).
- Several papers develop an adjusted productivity measures
  - Measurement of TSFP (total social factor productivities) Eg. Ehui and Spencer 1993 computes TFP for productions in Nigeria with a quantification of nutrients applied and extracted
  - Nanere et al., 2007 adjusted TFP incorporating environmental impact of soil erosion for the Australian Agriculture
Background (2)

• Ideally assessment of research investments should be evaluated vis-à-vis the research objectives/priorities
• but
  – Research priorities/objectives change over time and across countries
  – Research may just shift declinations
    • i.e. increase productivity vs sustainable intensification
  – New research objectives may arise
    • i.e. Bio-economy
• Changing research objectives implies enlarging/prioritizing outcome/impact indicators
• More complex pathways form research to impact
Background (3)

- External drivers
- Human resources
- Innovation & entrepreneurship
- Competitiveness/productivity
- Consumer surplus
- Public goods
- Well-being
- Education
- Intellectual property
- Applications; patents; publications
- Knowledige creation

Adapted from Campbell et al., 2013
Paper Objective

• General objective
  • Develop a methodology to assess impact of agricultural research expenditure taking into account both research objectives and multiple impacts of agricultural research

• Specific objectives
  • How to evaluate research priorities /objectives over time?
  • How to measure and identify multiple impacts of agricultural research?
  • How to characterise linkages between impacts and research priorities
Proposed methodology

• Three steps
  – A) Identification of research priorities across EU countries
  – B) Identification of impacts indicators
  – C) Relating priorities with impacts
A) Identification of Research Priorities

• **Approach**
  - Textual cluster analysis using word similarities to identify groups of projects with similar objectives
  - Attribution at the category of research priorities by word frequency

• **Data used**
  - No data available about research priorities across EU countries
  - Comparable data from EU projects FP4 –FP7 from cordis database
  - Data about financial contribution, abstract, duration, partner countries involved, subject, funding schemes
B) Selection of outcome measurements

• Dynamic factor analysis
  – Decompose multivariate time series into the sum of a reduced number of common trends and random noise
  – DFA quite new in statistical analysis and allows one to work with few observations taking into account changes across space and time

• Data used
  – Data from EUROSTAT concerning variables associated to economic, social and environmental dimensions
  – Assuming the existence of three factors
C) Relating research priorities to impacts

• Cograduation analysis
  – first insight of the direction of the association between research priorities and results of factor analysis can be obtained (Spearman’s rho)
  – Non parametric test based on ranking of two variables
Preliminary results

EU research objectives – NABS2 code

Expenditure for Agricultural project in FP4-FP6*

- Control and care of the environment
- Social structures and relationships
- Human health
- Animal Products
- Fishing and fish-farming
- Crops
- Forestry and timber production
- Food technology
- Renewable energies
DFA – factor loadings

**Factor 1**: Income and employment

**Factor 2**: Food industry and added value

**Factor 3**: Productivity and consumptions

**Variables**

- REAL_INCOME_AGRIC (F1+)
- ENERGY_PP_rel (F1+)
- EDU_EMPL_MALE (F1+)
- EDU_EMPL_FEMALE (F1+)
- LABOUR_FORCE_AGRIC_SALARIED (F2+, F2-)
- HH.exp (F1-, F2+, F3-)
- LABOUR_FORCE_AGRIC_TOT (F2-, F3+)
- GVAA_quota (F2-, F3+)
- TFP_INDEX (F3-)
- LABOUR_FORCE_AGRIC (F2+, F2-)
- LABOUR_FORCE_AGRIC_TOT (F2-, F3+)
- GVAA_quota (F2-, F3+)
Research priorities by country

share of budget between FP4

AT  BE  CZ  DE  DK  GR  ES  FI  FR  IE  IT  NL  PL  PT  SE  UK

sh_f1  sh_f2  sh_f3
Research priorities by country

GBAORD for each factor (1994-1998)
### Cograduation tests

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Discussion

• Preliminary and rough analysis
• Methodology seems feasible but needs improvements
• Relevant option to find proxy of research priorities expenditure
• Use of latent variables seems suitable when addressing multiple impacts
• Control for other effects (option to use meta-model for relevant confounding variables – i.e. policy; crisis etc.)
• Try to relational model taking into account expected path (SEM model)
• Sisyphean task(?)
  – proxy of research priorities/proxy of research impacts/»proxy» of research expenditure....
Thank you

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