UNIVERSITY OF Nebraska Lincoln
NEBRASKA CENTER FOR ENERGY SCIENCES RESEARCH

Accounting for Greenhouse Gas Emissions in OCDE Agricultural Productivity

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1. Background

- Farming accounted for about
- a quarter of total OECD acidifying emissions,
- 8% of the use of potential ozone depleting substances,
- 8% of greenhouse gases (GHGs) (2002-04).
- 70% of nitrous oxide N2Oand over 40% of methane CH4
- Consequences of GHGs Emissions :
  - ozone depletion
  - climate change,
  - … etc

2. Objective

- To analyze the environmental performance of the OECD agriculture with respect to Greenhouse Gases Emissions

3. Approaches and Data

- Data Envelopment Analysis : Malmquist-Luenberger (ML)Productivity Index

- $\vec{D}_o^t\left(x^t, y^t, b^t; g_y, -g_b\right) = Sup[\beta: (y + \beta g_y, b - \beta g_b) \in P^t(x^t)]$

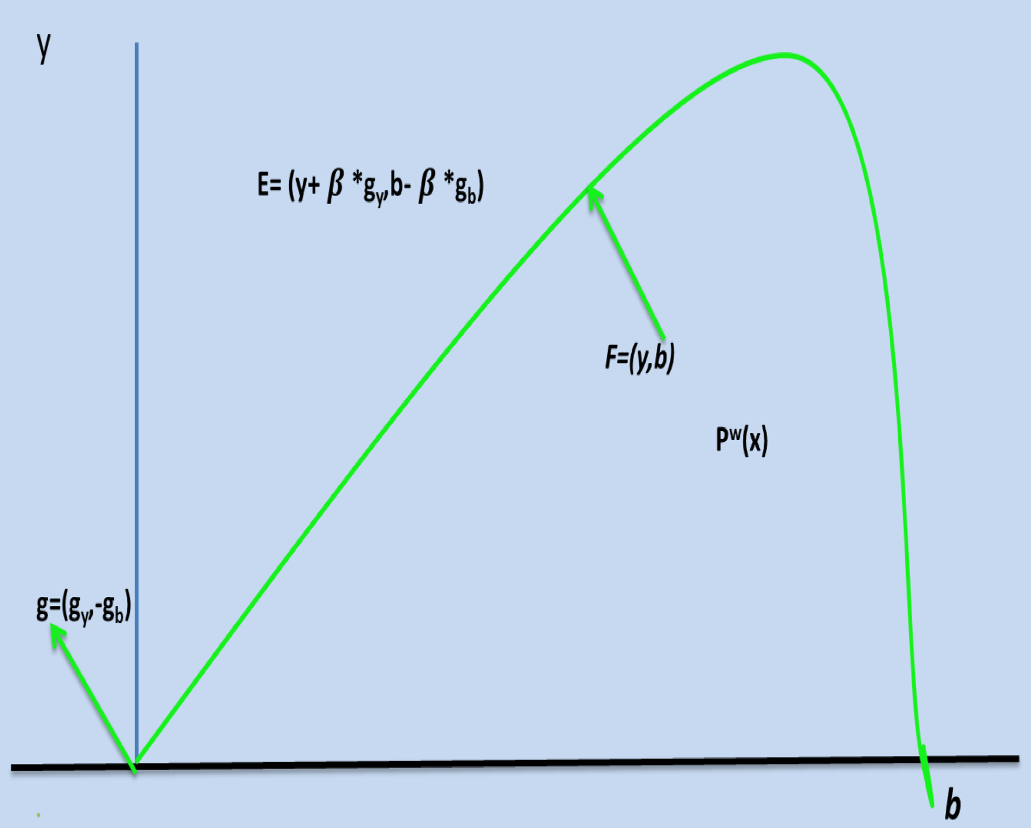


Fig 1. Directional Output Distance Function and Undesirable Outputs Färe(2005)

- Malmquist Luenberger . Chung , Färe and Grosskopf 1997
- $ML^t = [\frac{(1+\overrightarrow{D^t}(x^t, y^t, b^t; y^t, -b^t))}{(1+\overrightarrow{D^t}(x^{t+1}, y^{t+1}, b^{t+1}; y^{t+1}, -b^{t+1}))}]$
- $ML^{t+1} = [\frac{(1+\overrightarrow{D^{t+1}}(x^t, y^t, b^t; y^t, -b^t))}{(1+\overrightarrow{D^{t+1}}(x^{t+1}, y^{t+1}, b^{t+1}; y^{t+1}, -b^{t+1}))}]$
- $ML^{t,t+1} = [ML^t * ML^{t+1}]^{1/2}$
- $ML^{t,t+1} = MLTEFCH^{t,t+1} * MLTECH^{t,t+1}$

Data : 27 Countries data 1990-2006

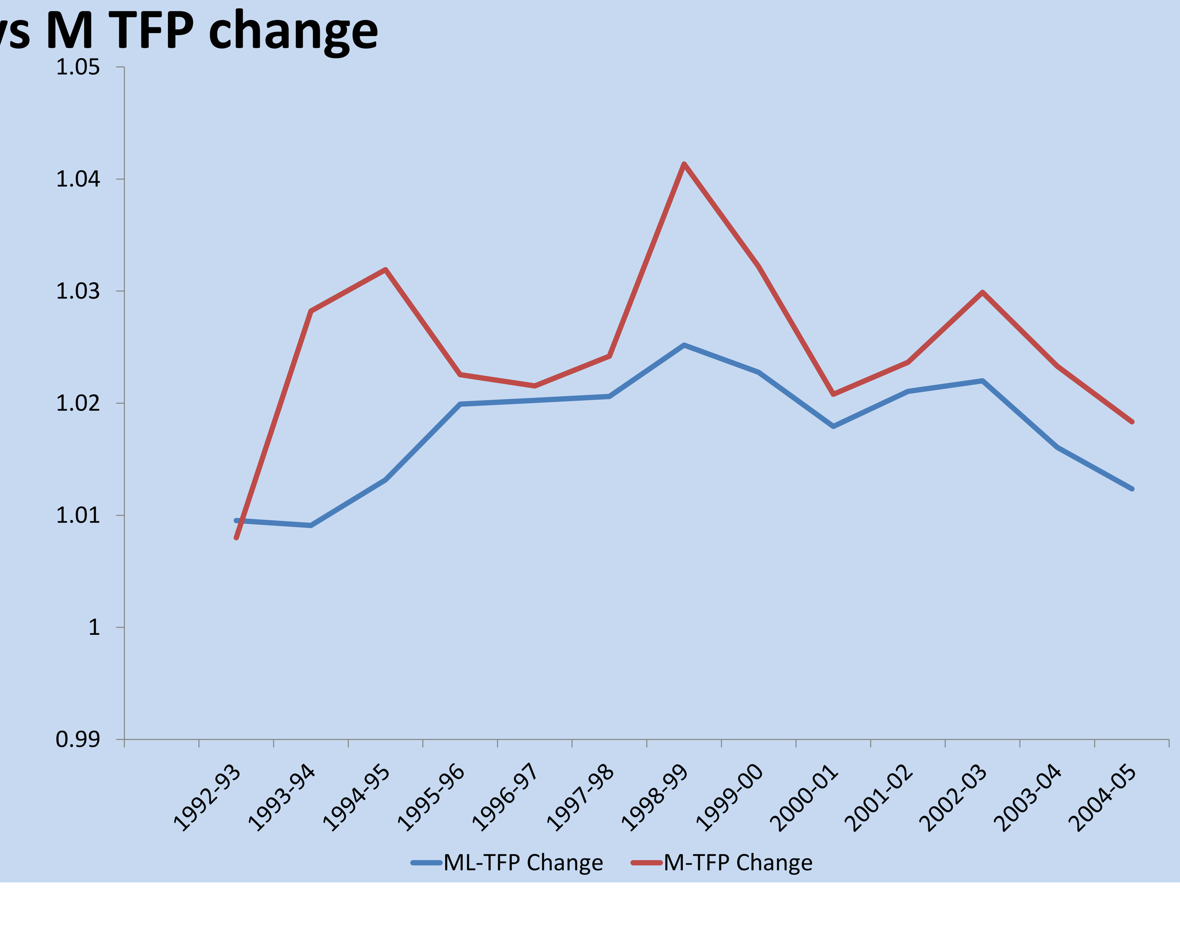
- **Desirable output : Production/Ind (2000=100)**
- **Undesirable Output : Agricultural total GHGs (Tonnes CO2 equivalent)**
- **Inputs : Land; Labor, Machinery, Energy, Fertilizer**

Source : OECD

4. Results

- **Efficiency Change accounting for GHGs averaged 0.3% vs 0.7% while ignored**
- **Technical Change accounting for GHGs averaged 0.1% vs 1.8% while ignored**
- **The ML productivity is driven by technical change**
- **and higher than the one ignoring the GHGs**

ML vs M TFP change



- **ML TFP growth is 2.5% vs 0.5% for the traditional Malmquist**

5. Conclusion

- **Accounting for GHGs results in lower TFP**
- **TFP is driven by technical change in both cases**
- **This performance is explained by technical change**
- **Technical change is biased toward expansion of desirable outputs rather than contraction of the bads**

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