

# Secondary effects of novel technology

**Language:** English

**Contact:** elin.martinsson@ilr.uni-bonn.de

## Background

The adoption and usage of novel technology is a crucial part to improved sustainability. However, as novel technology is adopted on farms, this can trigger secondary effects. We define secondary effects as structural and behavioural changes either caused by, or going together with, the adoption of novel technology. Economic theory can be used to derive mechanisms that generate secondary effects, for example rebound effects, risk balancing behaviour and economies of size and scope. While rebound effects and changes on farms due to changed risks could be expected to occur rather immediately after technology adoption, changes due to economies of size and scope can take longer to be realised.

For the following thesis topics, the student should investigate secondary effects of novel technology considering either of the theoretical concepts of rebound effects, risk balancing or economies of size and scope.

Apart from the two suggested topics, own ideas of studies of secondary effects of novel technology are welcome.

## Suggested thesis topic

### **An empirical study of economies of size and scope in Brazilian municipalities**

Brazilian agriculture is characterised by fast technological progress, as national policies have shifted to benefit technology adoption. Especially more efficient farms have sought out new technology and the increase in total factor productivity in Brazil can be traced back to the most efficient farms increasing their efficiency further.

**Objective:** Identify secondary effects of technology in Brazilian municipalities.

#### **Suggested approaches and directions:**

- Investigate the relation between economies of size and/or scale and novel technology in Brazilian agriculture on municipality level.
- Assess the presence of other secondary effects (adaptive behaviour) of novel technology in Brazilian agriculture.

#### **Literature to start:**

- **Brazilian agriculture:** Rada, N., and Valdes, C. (2012). Policy, Technology, and Efficiency of Brazilian Agriculture. In USDA-ERS Economic Research Report. <https://papers.ssrn.com/abstract=2112029>.
- **Economies of size:** Duffy, M. (2009). Economies of size in production agriculture. *Journal of hunger & environmental nutrition*, 4(3-4), 375-392.

#### **Data to start**

- Municipality-level data from ibge:  
*Census data from 2017:* <https://www.ibge.gov.br/en/statistics/economic/agriculture-forestry-and-fishing/21929-2017-2017-censo-agropecuaria-en.html?=&t=resultados>
- *Yearly agricultural data:* <https://www.ibge.gov.br/en/statistics/economic/agriculture-forestry-and-fishing.html>

## Literature search on the effects of increased water irrigation efficiency

Increasing water irrigation efficiency has been shown to generate rebound effects. There is already a body of literature reviewing the effects of increased water irrigation efficiency, focussing on rebound effects. Yet, no systematic overview of different types of direct or indirect effects of this technology is available. A literature review of the effects of water irrigation technology can provide important insights on the overall effect of improved water irrigation on sustainability and what primary and secondary effects can be identified for this technology.

**Objective:** To provide a systematic overview of the primary and secondary effects of improved water irrigation efficiency on (environmental) sustainability by means of a literature review.

### Suggested approach:

- Discuss potential secondary effects of improved water irrigation efficiency based on theoretical concepts.
- Compile previous empirical findings of improved water irrigation efficiency and discuss their implications for different aspects of sustainability (e.g. economic, environmental and social)
- Identify potential conflicts and synergies between theory and empirical results as well as trade-offs between different aspects of sustainability.

### Literature to start

- **Empirical study showing that improved water irrigation can cause increased water usage:** Pfeiffer, L., & Lin, C. Y. C. (2014). Does efficient irrigation technology lead to reduced groundwater extraction? Empirical evidence. *Journal of Environmental Economics and Management*, 67(2), 189-208.
- **Examples of spillover effects from more efficient water usage:** Li, M., & Long, K. (2019). Direct or spillover effect: The impact of pure technical and scale efficiencies of water use on water scarcity in China. *International journal of environmental research and public health*, 16(18), 3401.
- **For an example of how improved water irrigation can cause improved productivity:** Hassanli, A. M., Ahmadi-rad, S., & Beecham, S. (2010). Evaluation of the influence of irrigation methods and water quality on sugar beet yield and water use efficiency. *Agricultural Water Management*, 97(2), 357-362.
- **Literature review on rebound effects; Provides insights on how to conduct a literature review and rebound effects from water irrigation technologies:** Paul, Carsten, Anja-Kristina Tehen, James Scott Robinson, and Katharina Helming. 2019. "Rebound Effects in Agricultural Land and Soil Management: Review and Analytical Framework." *Journal of Cleaner Production* 227 (August): 1054–67.
- **An economic perspective on the potential gains from improved water irrigation efficiency:** Wichelns, D. (2002). An economic perspective on the potential gains from improvements in irrigation water management. *Agricultural Water Management*, 52(3), 233-248.