The Rebound Effect

Digitalisation and the Rebound Effect seminar
AS2020
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Motivation

common ground
Overview

• Historical Context
• Concept of Rebound Effect
• Quantifying Rebound Effect
• Rebound Effect in ICT
• Measures to Address Rebound Effect
Historical Context

Rebound in Energy Markets

- 1865: *The Coal Question* by William Stanley Jevons
- early Savory engine: positive feedback circle

\[
\begin{align*}
\text{increased demand} & \quad \text{efficiency improvement in steam engine} & \quad \text{lower-cost coal} \\
\text{lower-cost iron} & \quad \text{improved iron production} & \quad \text{increased demand}
\end{align*}
\]

- 1980: J. Daniel Khazzoom: *Implications of Mandated Efficiency in Standards for Household Appliances*
Historical Context

Rebound in Energy Markets

“with fixed real energy prices, energy-efficiency gains will increase energy consumption above what it would be without these gains”

- Khazzoom-Brookes postulate

S. Steve Sorrell: Jevons' Paradox revisited: The Evidence for backfire from improved energy efficiency, Energy Policy 37 (2009), 1456 - 1496,
A Closer Look on Direct Rebound Effect

Concept

- Efficiency improvement
- Zero rebound
- Rebound
- Backfire

Inspired by Vlad Coroamă (ETH), Digitalisation and the Rebound Effect seminar, 17 September 2020
**Direct, Indirect and Overall Rebound Effect**

- **Direct rebound effect**
  - *single service model*
  - economy with one good
  - smaller cost → increased demand

- **Indirect rebound effect**
  - *multi service model*
  - economy with many different goods
  - smaller cost → increased demand for other goods

**Overall rebound effect + backfire**

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A Closer Look on Indirect Rebound Effect

**SE: substitution effect**
replacement of one good for another

**IE: income effect**
change in income -> change in behaviour (more/less consumed)

B = transportation budget

Empirical Observations

Empirical studies on the rebound effect in car use

- effect of empirical relevance
- size dependent on method and data
- ~ 5 – 30 %
- no backfire

Quantifying Rebound Effects

Assumptions and Problematics

neo-classical economic principles

- rationality
- insatiable preferences
- need to optimise
- complete information
- no uncertainty
- negligible adjustment-costs

Rebound Effect or preference change?

Rebound Effect in ICT

General Purpose Technology

- wide scope for improvement
- many use-cases
- used in products and processes

→ economic growth
→ innovation
→ productivity
→ increased manufacturing cost

big potential for rebound effects in ICT

Steve Sorrell: Jevons' Paradox revisited: The Evidence for backfire from improved energy efficiency, Energy Policy 37 (2009), 1456 - 1496,
Eric Williams: Environmental effects of information and communication technologies, Nature (2011)
Rebound Effect in ICT

Rebound Effect with Respect to Time

transportation

- time saved?
  - longer commuting distances
  - inefficient distribution of goods

- energy saved?
  - production and usage consume more energy

→ 2x rebound effect

shopping

Measures to Address Rebound Effect

Join at
slido.com
#rebound2020
Recommended Measures to Address Rebound Effect

1. Account for rebound effect in design and evaluation of policies
2. Mix of fiscal, behavioural and technological instruments
3. Sustainable lifestyles & behaviour in customers
4. Awareness raising & education for behaviour change in business

Maxwell, D., Owen, P., McAndrew, L., Muehmel, K., Neubauer, A., Addressing the Rebound Effect, a report for the European Commission DG Environment (2011)
Summary

- rebound effect in energy efficiency
- different levels: direct, indirect and overall rebound effect
- income effect and substitution effect
- (zero) rebound or backfire: difficult quantification
- general purpose technologies
- rebound effect with respect to time