

Determinants and potential magnitude of economy- wide rebound effects:

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Rebound trigger

- Distinction: price of a physical unit of energy and price of the 'energy service' that it delivers
- Increase efficiency – less energy required to deliver the service, thereby lowering its implicit price
- Trigger for a complex chain of demand and supply responses throughout the economy

Production case

- E. g. increased energy efficiency in manufacturing
- Energy becomes cheaper relative other inputs.....substitution effect (direct rebound)
- Lowers overall production costs and therefore price of output.....competitiveness effect
- Economy grows – productivity improvement - increased incomes....income effect
- Trigger for rebound is also a trigger for economic growth (trade-off)

Consumption case

- E. g. increased efficiency in household energy use
- Energy becomes cheaper relative other consumption goods.....substitution effect (direct rebound)
- Impact on wider economy?
- Shifts in demand
- Lowers household cost of living, freeing up income to spend on other things....first income effect (indirect rebound)
- Changes in demand (up or down) impacts prices, revenues, production levels
- Transmits to lower wage demands?
- Economy will grow triggering wider income effects – but not a productivity improvement as such – key is impact on competitiveness

Key energy demand effects

- Direct demand responses as price of energy relative to other inputs/consumption goods falls
- Need to determine strength of this for different activities, in different time periods, under different circumstances – how do consumers identify and respond to price changes? How big is the effective price change?
- Income effects – how do consumers redirect freed up income? How does this further impact on prices throughout the system?
- Derived demand responses – e.g. how do domestic and export demands respond to changes in competitiveness?
- What other incomes and prices change throughout the system?

Key finding of our rebound research (1)

- Indirect rebound may not be positive
- As consumers increase use of non-energy goods when income is freed up, they increase their (indirect) use of embodied energy
- But as they decrease their use of energy, they decrease their (indirect) use of energy embodied in energy production
- Energy supply tends to be energy-intensive – negative multiplier effectssource of potential negative rebound effects

Supply side effects

- E.g. if household demand for energy falls when efficiency increases, does this lower the market price of energy?
- The physical price as well the implicit price?
- Oil? Determined on world markets
- But we don't consume crude oil
- If we have local capacity and markets for refined oil, electricity etc, local supply price will be affected

Key finding of our rebound research (1)

- Energy supply response to demand changes resulting from increased efficiency in use of energy may constrain size of rebound effects
- If revenues to local energy suppliers fall, reduced incentive to invest in production capacity
- May push up local price of energy – e.g. price at pumps, electricity bills
- Impacts on demand responses identified above
- Causes erosion of economy-wide rebound over time

Analytical requirements (1)

- Determinants of direct rebound may be similar for particular activities across different economies
- However, issues in terms of how efficiency improvement is introduced, how well agents identify and respond to effective price change
- But indirect and economy-wide rebound depend on structure of economy in question
- Also issue of interdependence between economies

Analytical requirements (2)

- To look at economy-wide rebound, need multi-sectoral, economy-wide empirical frameworks
- Good up-to-date input-output accounts with detailed energy supply and demand data
- Also, link to pollution generation
- If interested in inter-economy effects – good trade data in input-output format
- If interested in different household income groups, need household disaggregation in data

Analytical requirements (3)

- Need to estimate strength of key relationships
- Parameters governing substitution, competitiveness and income effects in different types of production and consumption activities
- Huge task – need to prioritise in terms of (a) importance in determining rebound, (b) policy challenges

Types of models?

- Direct rebound – micro econometric estimation
- However, indirect and economy-wide rebound depend on complex interactions between different producers and consumers throughout the economy – general equilibrium analysis
- Indirect rebound – could use demand driven Leontief input-output (nominal income and prices fixed)
- Economy-wide rebound – require more flexible computable general equilibrium models (supply and demand, prices and quantities)

Existing research

- CGE has become main approach in considering economy-wide rebound (mainly single country/region)
- Focus on how rebound effects transmit from initial change in price of energy services
- Two priorities:
 - Now identified key factors driving (or constraining) rebound, need to improve treatment
 - Modelling how efficiency improvements come about (e.g. whether investment required or not)

- Thank you for listening
 - Questions?