The rebound effect: a tassel in the study of technological change dynamics

Innovation for climate change mitigation: a study of energy R&D, its uncertain effectiveness and Spillovers

E. Verdolini

Washington, DC, 2011/06/28

0. Outline

Main goal of the presentation:

Stop speaking before Granger's phone sets off the "fire" alarm

Still manage to give you a clear idea about:

1. Who (we are) and What (we do)
2. Why (we care about RE)
3. How (are we thinking of contributing)
4. Main lessons learned
5. Unanswered questions/issues

1. Who (we are) and What (we do) (1/2)

- ICARUS project (3-year JRC-funded) www.icarus-project.org
  - Econometric analysis of technological change dynamics
  - Expert elicitation
  - Improvement of climate economy models (WITCH)
- PURGE Project (3.5-years FP7-funded)
  - Rebound effects (consumer and industry) for selected EU countries and China.
- Energy Demand Work Group
  - Assessment of energy (and environmental) policies (support for renewables, etc.)
  - Modelling work - ICES and WITCH

Assess the implications of environmental/energy policies:

1. Innovation, technology diffusion, spillovers
2. Energy demand (mostly at the macro level)
3. Interactions of (1) and (2) with energy efficiency/GHG emissions
4. (1)+(2)+(3) = Policy recommendations

1. Who (we are) and What (we do) (2/2)

Our resources:

- **ICES** - a recursive dynamic CGE model (8*17)

http://www.feem.it/getpage.aspx?id=138&sez=Research&padre=18&sub=75&idsub=102

- **WITCH** - an integrated assessment model (12)

http://www.witchmodel.org/

- **Researchers doing econometric work**

2. Why (do we care about RE)

The magnitude of the “RE” has implications for

1. Models’ predictions
2. Energy demand
3. How innovation translates into increased efficiency
4. Net effect on GHGs emissions

3. How (we would like to contribute)

FEEM researchers are currently focusing their effort on two research areas:

- **Economy-wide RE analyzed through climate economy models (ICES and WITCH)**

- **Empirical studies/estimates of energy demand and RE dynamics for consumers and the manufacturing sector in the EU**

3. How (we would like to contribute) (1/2)

Economy-wide "RE":

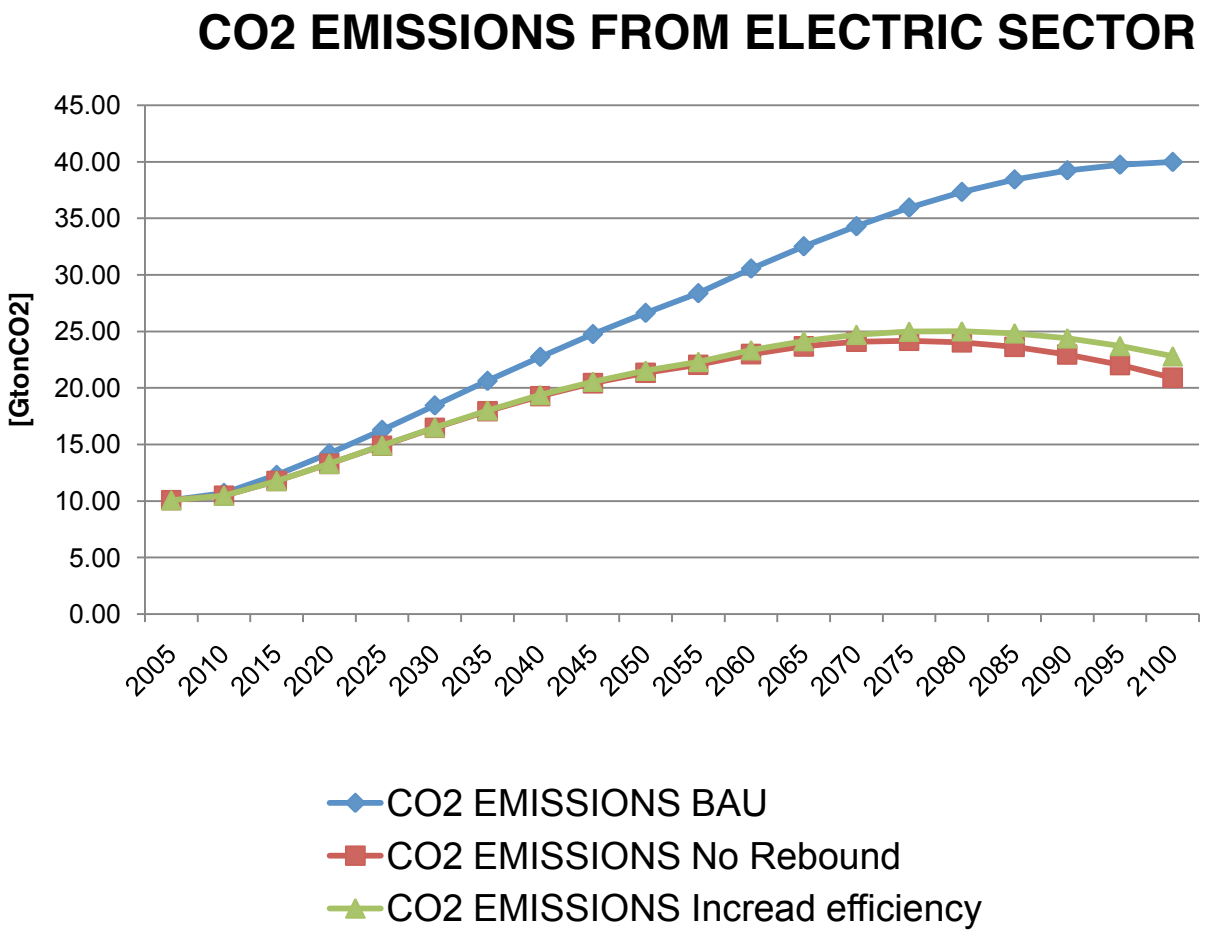
ICES: exogenous TC. Lacks the ability to simulate a behavioral response induced by increases in efficiency and changes in prices

(1) Include ETC in ICES (R&D stock of knowledge – added to GTAP database)

(2) Study extent of rebound effect dynamics

WITCH: based on ETC. What happens when the model is used to estimate rebound? (see next slide)

3. What we plan to do (1/2)a



Do we have a problem?

3. What we plan to do (2/2)

Energy demand (RE) for manufacturing and consumers

(1) Micro: surveys

a. For Italy (Household Expenditure Surveys)

b. PURGE: (?) surveys for China and Eastern EU countries

(2) Macro: historical analysis of energy demand and use can be very informative (even if not about magnitude of RE)

(3) Macro: (possibly) extend the analysis of Harry Saunders (2011) to EU countries. *Challenges?*

6. Main lessons learned

- (EU) If policy makers believe that increased efficiency will ALONE lead to lower energy demand maybe worth spending time explaining what they should really be expecting
- Need to clarify what Rebound Effect is and what it measures
- Reinventing the wheel is costly. Taking stock of past research
- Having said that, rebound effect dynamics need to be understood (validate the strenght of models' results)
- Energy demand and RE estimates depend on sector/economy in which they are studied. Important to extend previous analysis
- Energy demand and RE has been studied from a "country" level, but less attention for implications in global markets and with respect to global emissions

6. "Unanswered" questions

- Q1: Is rebound in and of itself a bad thing?
  - RE is relevant for effect on CO2 emissions (plus concern for use of primary inputs)
- Q1A: Shouldn't we add a layer of complexity, stemming for recent debates on directed TC and substitutability of clean vs dirty energy/innovation? (KLEM vs "KLCDM")
- Q1B: What are the implications of environmental and energy policies for price expectations? How do these affect demand (and RE)? Particularly relevant for EU (bouquet of policies)
- Q2: Are there possible spillovers linked with energy demand and RE dynamics? (parallel with Green Paradox and Leakage)
- Q3: (Econometric Analysis) Once you identify the problem (i.e. trade) how can you operationalize it in the estimations?

Thanks

The research leading to these results has received funding from the European Research Council under the *European Community's* Seventh Framework Programme (FP7/2007-2013) / ERC *grant agreement* n° 240895 – project ICARUS "Innovation for Climate Change Mitigation: a Study of energy R&D, its Uncertain Effectiveness and Spillovers".