Innovation and stabilization policies

A numerical analysis using WITCH

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Main Policy Messages

Three key messages:

1. **R&D will be an essential part of any serious climate policy**; stringent targets will create higher carbon prices which will induce a surge of R&D investments
2. **R&D policy alone will not suffice**, unless the goal is simply to diversify energy provision rather than significantly reduce emissions
3. **Combining R&D and climate policies** (as for example through an international fund for breakthrough technologies R&D) **leads to moderate efficiency gains and helps contain climate policy costs**

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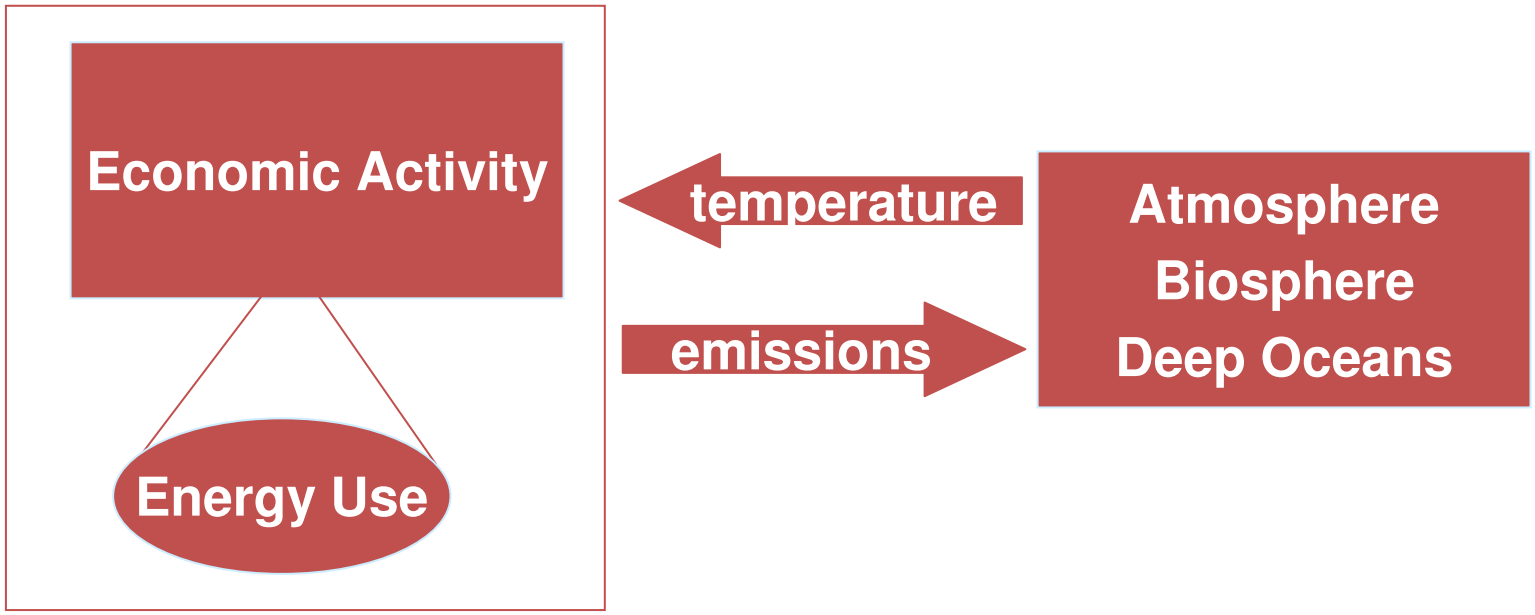
The WITCH Model

A World Induced Technical Change Hybrid Model

WITCH: World Induced Technical Change Hybrid model

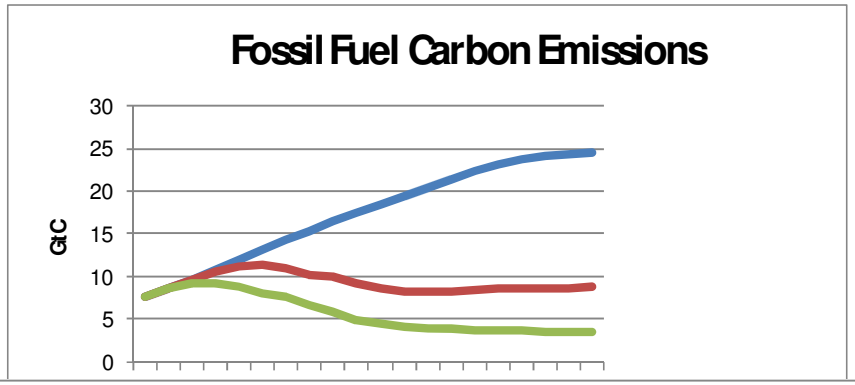
Hybrid I.A.M.:

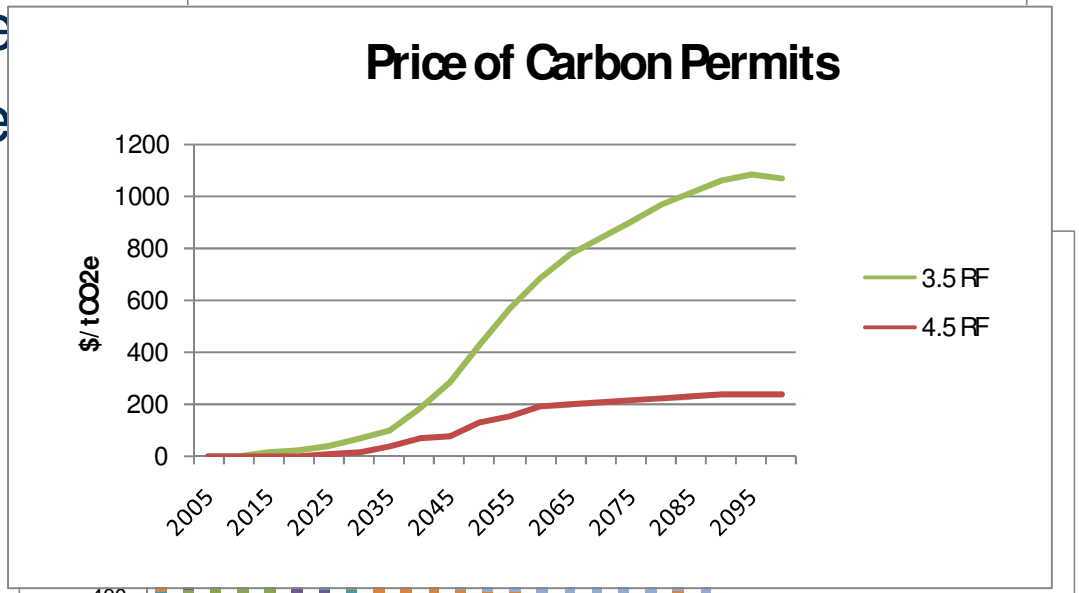
- Economy: Ramsey-type optimal growth (inter-temporal)
- Energy: Energy sector detail (technology portfolio)
- Climate: Damage feedback (global variable)

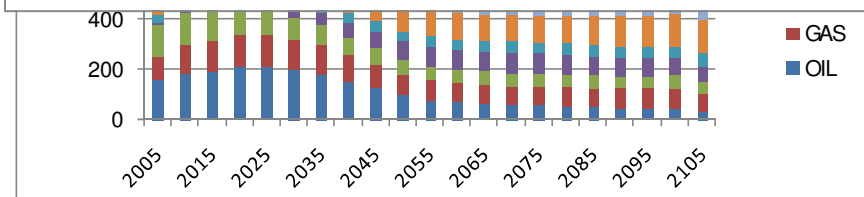


1. Stabilizing the Climate and R&D

- The challenge of stabilizing the climate will require a massive change in what the energy sector looks like
- To drive such a change strong carbon price signal will be crucial
- Policy costs would be respectively1.5% and 0.4% for the 3.5 RF and 4.5 RF scenarios

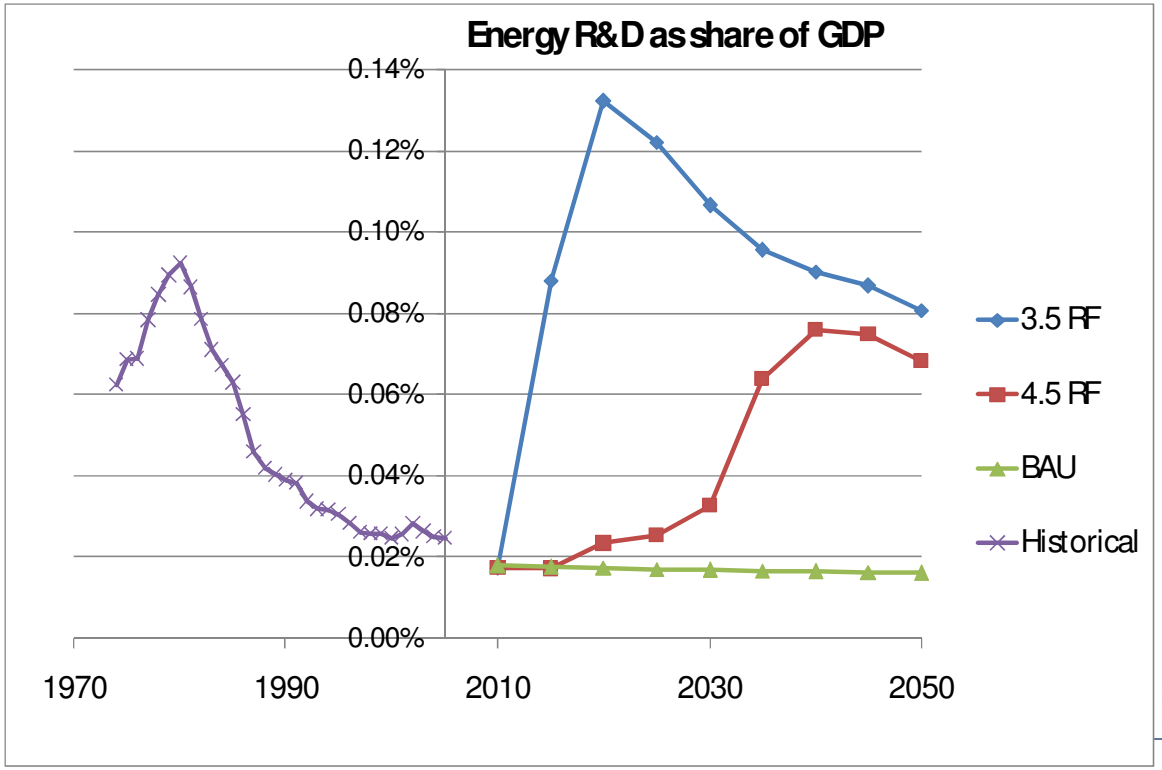






1.a Stabilizing the Climate and R&D

- Assuming cooperation on climate change is ensured, as a response to higher and increasing carbon prices investments in total public R&D will have to rump up to face the challenge ahead



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1.b Stabilizing the Climate and R&D

- What if the carbon price fails to trigger the necessary R&D investments (we know policy makers are not optimal forward looking agent)?
- Breakthroughs could be delayed by two decades, hence deployment and learning-by-doing would be delayed as well
- Policy costs could increase drammatically: for the 3.5 RF scenario costs could increase **by 70%** (measured as discounted GWP losses)

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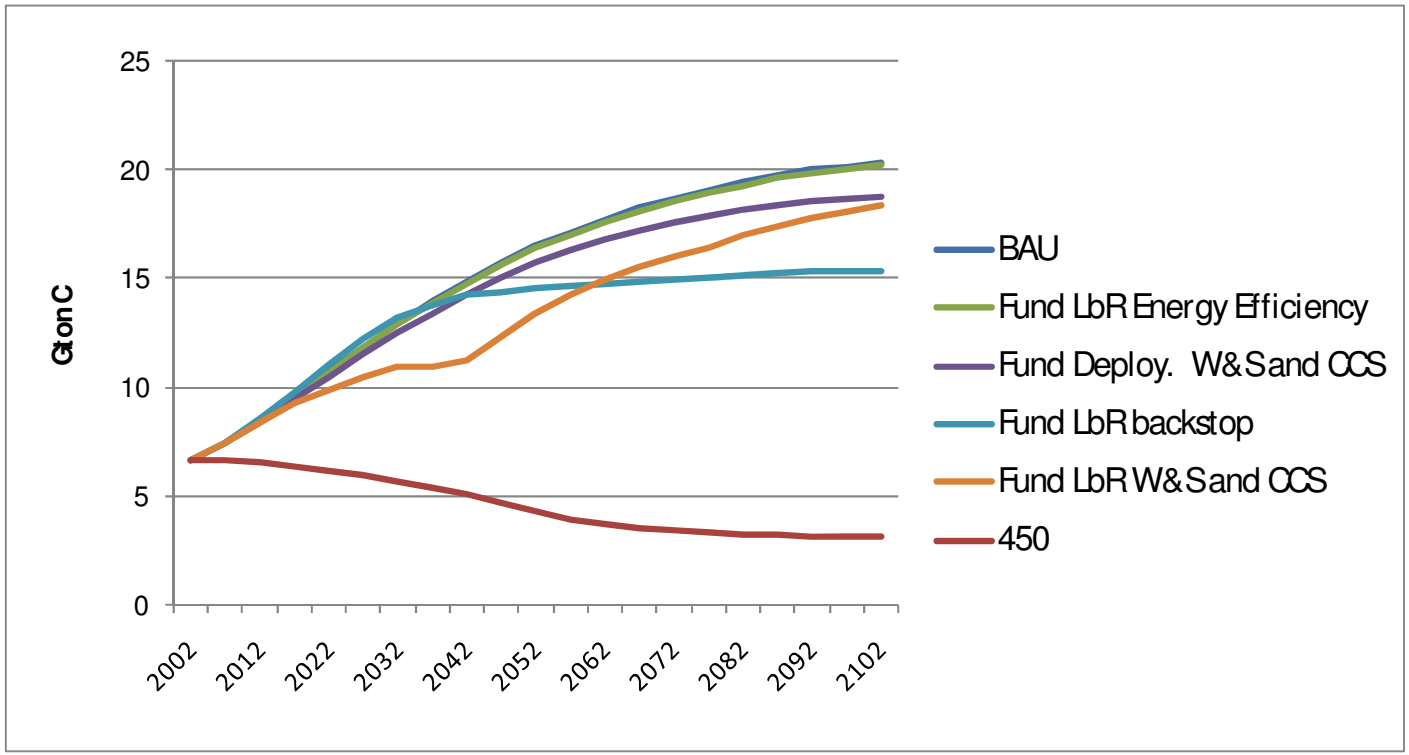
2. R&D Efforts: Necessary but not Sufficient

- Across a wide range of simulations: largest achievable reduction in cumulative emissions with respect to the BAU is in the order of 13 to 16 percent, if R&D fund is the ONLY POLICY SIGNAL
- To put this in perspective, the reduction required to be consistent with a mild stabilization target (550 ppm CO2) would be in the order of halving cumulative emissions.



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3. Why adding a R&D policy to a carbon policy?

- To foster the development and deployment of carbon-free energy technologies
- R&D external effect lead to under-investments in R&D by the private sector
- To increase absorption capacity in developing regions
- To better allocate the burden of adapting to and mitigating climate change

- Can technology cooperation really be effective in achieving the above objectives?
- What's its impact on policy costs and their distribution?

3. Why adding a R&D policy to a carbon policy?

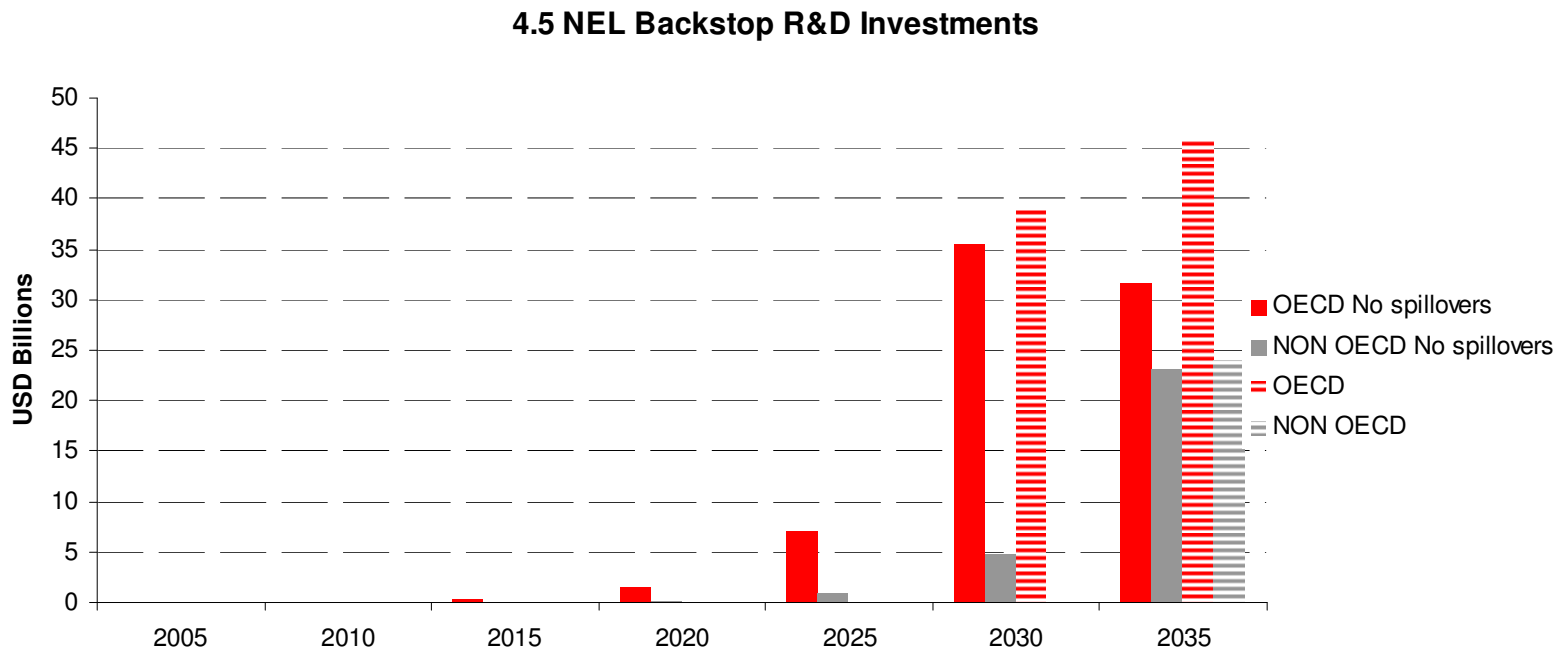
- Adding a R&D international fund has a value increasing with:
  - The sub-optimality of policy makers' response to the carbon price
  - The mildness of the target
  - The positive externalities associated with R&D

3.a Why adding a R&D policy to a carbon policy?

- What if we added an international R&D fund to increase the absorption capacity of developing countries?
  - When the target is stringent (as in the 3.5 RF scenario) the carbon signal is high enough to internalize completely the technology externality and stimulate already very large R&D investments in both developed and in developing countries
  - When the target is milder (as the 4.5 RF scenario), an international R&D fund can bring stabilization policy costs down by 5% to 10%, as the much lower carbon signal fails to stimulate the socially optimum level of energy R&D

3.b Why adding a R&D policy to a carbon policy?

- What if there were no spillovers in R&D?
- Costs would not be substantially affected, although a different distribution of the R&D effort would be required, both in terms of time and through regions.



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3.c Why adding a R&D policy to a carbon policy?

- Our empirical study of spillovers points indicates that:
  - Both demand-push and supply-pull effect are confirmed in a multi-country empirical analysis that includes both developing and developed countries
  - Knowledge in energy efficient technologies diffuses between countries
  - Knowledge flow is affected by geographical and technological distance of the sending and receiving country
  - The external knowledge stock that diffused to any given country produces spillovers, namely contributes to increasing the level of own innovation

Thank you!

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