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Economic valuation of the impacts of black carbon and methane mitigation

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What’s the purpose of valuation?

- Identify which measures to prioritize?
- Highlight gains from measures undertaken?

- From which perspective?
  - National versus global
  - Process has focused on global gains so far
  - National gains more politically relevant
  - Flows of gains relevant for cooperation

How to calculate national gains and flows

For each mitigation action in each country:

1. Quantify flow from source country to receptor country
2. Estimate impact of flow

Use TM5-FASST for health and crop damages

- 56 regions
- Track each mitigation measure from source to receptor
- Provides health/crop impact of concentration changes

How to calculate national gains and flows

3. Valuation of impact
   - Valuations exist, comptutationally trivial
   - Ethically/politically non-trivial

4. National climate valuations as shares of global social cost of carbon

5. National impact $\sum_{d=1}^{d=3} C_{m,i,d,j}$

6. Global impact $\sum_{d=1}^{d=3} \sum_{j=1}^{N} C_{m,i,d,j}$

Health benefits

Impacts

- Annual premature mortalities from exposure to O_3 and $PM_{2.5}$.
- Risk rates for O_3 using M6M ozone exposure metric.
- Risk rates for $PM_{2.5}$ using Integrated Exposure-Response functions, as in e.g. Global Burden of Disease study.

Valuation

- Use value of statistical life?
  - Values from OECD? US EPA?
  - Use uniform values?
  - Use income elasticity to adapt to individual countries?
  - Use national values instead?
  - Ethically non-trivial.

Crop benefits

Impacts

- Impacts on 4 crop-yields (wheat, maize, rice and soy bean) from TM5-FASST.
- M7 or AOT40 ozone exposure index.

Valuation

- Use market value of crops to monetize.

Climate benefits

- We use national shares of the global social cost of carbon (SCC).
  - Converted from CO_2 to CH_4 or BC (incl. co-emissions) using GWP100.
  - Shares of global SCC from Nordhaus' **C-DICE** model.

- Alternative 1: Shindell (2015) Social Cost of Atmospheric Release for climate:
  - RF of each pollutant.
  - Temperature response calculated using the time dependence of the impulse-response function from the Hadley Centre climate model.
  - **DICE** 2007 IAM damage function.

- Alternative 2: Rautiainen & Lintunen (2017) Social Cost of Forcing
  - Calculate social cost of incremental unit of RF (based on **DICE**).
  - Temporal decay profile and radiative efficiency of forcing agent.

Illustration

- Worthwhile differentiating between *measures* and *countries*

Country	$US (1000s)/t BC
Global	
China	400 - 6,300
India	300 - 3,100
Russia	500 - 4,300
USA	0 – 500
Canada (x100)	300 - 400

Country	$US/t CH_4
Global	3,500
China	900
India	400
Russia	100
USA	300
Canada (x10)	200

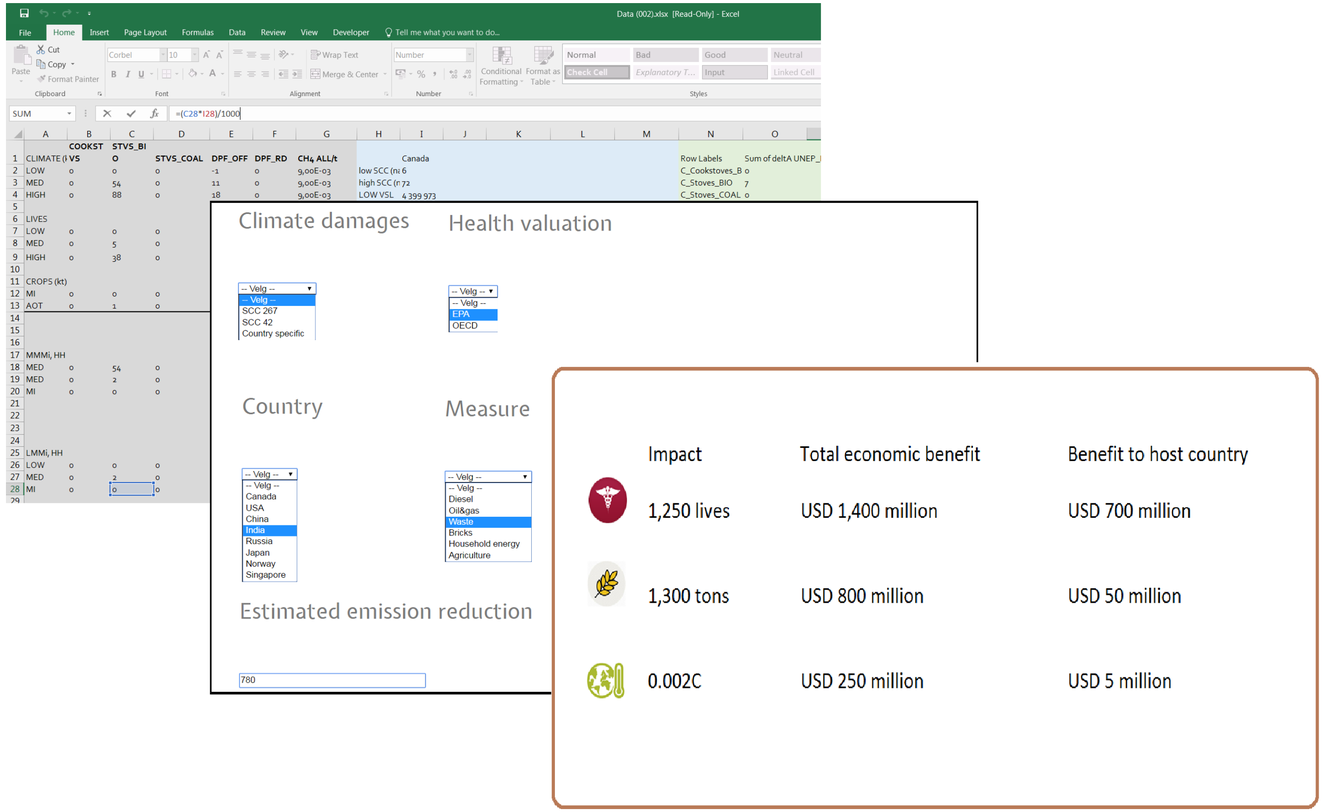
Focus on net benefits?

- Subtract mitigation costs
- Self-interested mitigation and the role of cooperation

- Benefits and costs ($US million) from mitigation in Russia

Measure	Total benefits	Total costs	Net benefits
Bio heating	7,900	400	7,500
Coal heating	5,800	~0	5,800
Off-road diesel	9,200	10,200	-1,000
CH_4	1,300	5,000	-3,700

Proposal – valuation tool



Database – Valuation & policy choices - Scorecard

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Proposal – valuation tool (cont.)

- Consistent valuation of measures
- Country and measure specific valuations
- Can be used to identify:
  - National self-interest
  - Promising international cooperation
    - What *types*?
    - *How?*
      - Pollutants
      - Measures
      - Actors
  - Scope for side payments

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