Closing the emission price gap

A multiple dividend approach to carbon pricing

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Workshop Economic Challenges for Energy

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The BAU Scenarios could exceed the level of Greenhouse Gas Concentration of 600ppm (~4°C temperature increase)

SRREN (IPCC, 2011)
The Atmosphere as a Global Common

Atmosphere: Limited Sink
~ 230 GtC

Resource Extraction
> 12.000 GtC
• Development of new technologies and learning effects crucial for technology portfolio and mitigation costs

• A price on carbon is necessary, but not sufficient – optimally complemented by technology policies
What are the CO$_2$ prices and Social Cost of Carbon?

**Main Results**
- **EPA** start at relatively high levels, but increase only linearly.
- Stabilization prices start relatively low, but increase exponentially.
- If we agree on some consensus the range narrows down a lot.
The emerging landscape of carbon pricing

Figure 1: Map of existing, emerging, and potential emissions trading schemes

Status of implementation
- Implemented (in force with established rules)
- Implementation scheduled (mandate agreed, start date communicated, rules in preparation)
- Under consideration*** (government gave public signal towards the development of an ETS)

Offsetting
- National
- Sub-national or regional

Linking
- Planned link

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- Tax mandated by theory of optimal taxation
- Pigouvian tax internalizing *domestic climate impacts*
- Co-benefits (air quality, energy access, etc.)
- Macro-economic efficiency
- Global optimal carbon price

Remaining gap – intl. negotiations

Addressed by:
- Domestic ministries of finance / economy / development
- Domestic ministries of the environment
- International Climate Negotiations
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$\$/tCO_2$

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Ramsey Rule

• In order to raise a given amount of public income, all economic factors should be taxed inversely to their elasticity of supply (Ramsey Rule)

• Carbon tax would be mandated even if climate change were not an issue
Traditional „Double Dividend“

- Impose CO$_2$ tax and reduce labor and capital taxes
- Some indicate net benefit of this policy (e.g. Goulder 1995, Parry 1995)
- Could also be used to pay back public debt (Rauscher 2013) and broaden the tax base in countries with large informal sector (Markandya 2013)
- Problems:
  1) Upshot of scientific debate inconclusive
  2) Omits challenge for governments to deal with tax competition and maintain international competitiveness
  3) Productivity-enhancing infrastructure investments out of scope
- Given needs for infrastructure investments, probably not optimal to fully recycle carbon revenues by lowering other taxes
Infrastructure investment

- Achieve universal energy access by 2030: US$ 36-41 bln per year (Riahi et al. 2012)
- “Great convergence” of global health standards by 2035: about US$ 40 bln per year (Jameson et al. 2013)
• Substitution elasticity determines „relative fixedness“ of fossil resources
• Factor taxes distort the *intertemporal* allocation
• Capital mobility distorts the *interregional* allocation through tax competition
• Capital tax more prone to tax competition than carbon tax under plausible parameters
• Infrastructure financed by carbon taxes attracts inflow of private capital and tames intertemporal and interregional distortions

Franks, Edenhofer and Lessmann (in preparation)
Fossil resource rents decrease with climate policy ambition

For a globally optimal carbon price, over-compensation by carbon rent (=permit price or tax * emissions)

Carbon rent appropriated domestically via auctioned permits or tax

Would also provide resources to address climate issues not tackled by a carbon price, e.g. technology policy and adaptation

Bauer et al. (2013)

Magnitude of carbon rent
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• Agents over-invest in fixed (rent-bearing) factors (such as fossil fuels, land) and underinvest in productive capital formation (Edenhofer et al. 2013)

• This distortion creates economic inefficiencies and slows down economic growth (Mattauch et al. 2013)

• Hence, taxation of carbon emission and/or land can reduce this inefficiency (Siegmeier et al. in preparation) to achieve optimal balance of portfolio

• **Optimality:** Pure rate of time preference equal to returns of risk-free asset, social, private, natural, and human capital

\[
\rho = r = F_{K_S}(K_S, K_P, K_H, K_N) - \delta K_S = F_{K_P}(K_S, K_P, K_H, K_N) - \delta K_P = \frac{l}{p} + \frac{p}{p} = h
\]

Social rate of return equal for all forms of capital (i.e. “no arbitrage condition”), otherwise there is over- or under-investment.
Enhancing macro-economic efficiency – the spillover argument

- An optimistic perspective regards green technologies as a potential basis for a ‘Green Industrial Revolution’ (Stern 2009)
- Recent evidence suggest higher technology spill-overs of green technologies (Dechezleprêtre et al. 2013)

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*Notes: The first two columns report the mean values and standard deviation in parentheses. The last column is reports a t-test for the difference in means with the standard error in parentheses. *** indicates significance at 0.1% level.*
Social returns of infrastructure investments

- Even though infrastructure is underprovided by the market, this under-provision does not necessarily need to be addressed by public ownership.
- Alternative arrangements include e.g. subsidies, vouchers, auctioning of contracts...
- Empirical evidence of efficiency of public vs. private infrastructure mixed
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Pigouvian tax internalizing *domestic climate impacts*

Macro-economic efficiency

Co-benefits (air quality, energy access, etc.)

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Global optimal carbon price

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$/tCO_2$
Internalizing domestic impacts

• Even if countries behave in a purely selfish manner, they would optimally impose a price on carbon to internalize the damage their emissions inflict on themselves.

• The higher the damages, i.e. the richer or the more populous a country, the higher the resulting carbon price.

(Lessmann, unpublished)
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$/tCO_2$
Co-benefits

• Besides reducing GHG emissions, several additional benefits:
  • Ambient air quality (Nemet 2010)
  • Public transport, reduce congestion and urban sprawl (Creutzig and He 2008)
  • Technology spill-overs (Jaffe and Stavins 2005)

• Case study evidence suggests that for many countries these motivations were more important than environmental concerns for the adoption of climate policy, e.g.
  • India: Energy security (Dubash 2013)
  • Vietnam: Energy efficiency, economic restructuring (Zimmer, Jakob, Steckel, submitted)
Multi-dividend perspective – Synergistic policies

- Multiple objectives, e.g. climate change (CC), fiscal benefits, energy security (ES), pollution/health (PH)
- Synergistic relationships
- Reduced added costs of supplementary policies for other objectives
- Climate mitigation is strategic entry point to achieve an array of goals
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International negotiations

• Often argued that unilateral action is countered by free-riding (Barrett 1994, Carraro and Siniscalco 1993)

• Recent research has shown that first mover emission reductions can be strategic complements instead of substitutes (Edenhofer et al. 2013)
  • Technology spill-overs and learning by doing (Heal and Tarui 2008)
  • (Imperfect) altruism and reciprocity (Lange and Vogt 2003)
  • Signaling of willingness to pay (Jakob and Lessman 2012)

• Conditionality rules could act as an incentive to increase ambition
• By iterative processes, unilateral actions might result in more global cooperation (Edenhofer, Flachsland, Stavins, Stowe 2013)

• Unilateral actions could form the basis of a hybrid agreement (Edenhofer et al. 2013)

• International agreement as institution to coordinate national policies, share information, and act as a focal point for expectations

• Conditionality could act as an incentive to increase ambition
X-Cut I: First mover challenges

- **Carbon Leakage**: Recent research finds
  - Böhringer et al. (2012): 5-19% (median 12%)
  - Also negative leakage possible
    - Positive technology spill-overs (Bossetti et al. 2009)
    - Crowding out of dirty capital (Carbone et al. 2013)
    - Inter-fuel substitution in third countries (Bauer et al. 2013)
  - Tailored policies can reduce leakage
    - Trade measures (Jakob, Steckel, Edenhofer, forthcoming)
    - Free allocation of some emission permits (Hepburn 2013)

- **Costs**:
  - Modeling indicates moderate costs from a period of moderate unilateral carbon pricing
  - Delaying global agreement by 15 years would raise costs of achieving 450ppm CO$_2$-only by at least half (Jakob et al. 2012)
X-Cut II: Some political economy considerations

- **Energy-intensive industries** - some compensation for losers?
- **Carbon price impacts on equity:**
  - Carbon price not necessarily regressive (Rausch 2011)
  - Can be made progressive by lowering taxes in a way that benefits low earners (Metcalf et al. 2010) or provide infrastructure that benefits them more than others
  - Ensure buy-in of key stakeholders by ownership, e.g. inspired by property owning democracy (Meade 1946)
- Benefits of carbon pricing should be examined in a **multi-objective framework** rooted in welfare theory (Jakob and Edenhofer, submitted)
“[T]he carbon tax is not a free lunch. However, ..., it still might be a meal worth paying for!” (Goulder 2013)

“$100–600 billion annually by 2030 in reduced pollution control and energy security expenditures.” (McCollum et. al 2012)

- Different people may have very different assumptions of physical and economic mechanisms as well as different preferences
- Yet, they still may agree on a more or less similar carbon price
- Elaboration of benefits in multiple dimensions allow identifying range of acceptable prices and does not need to rely on a single ‘killer argument’
Conclusions

• Ambition of international climate policy rooted in domestic ambitions
• Domestic climate policy embedded in broader public policy concerns
• Domestic multi-dividend perspective:
  • Optimal taxation, double dividend, taming capital tax competition
  • Improving macro-economic efficiency, investment of revenue in areas with highest social return
  • Reduction of CO₂ emissions mitigates climate change
  • Positive synergies with other issues such as air pollution and technology spill-overs
• These considerations might not achieve globally optimal carbon price, but help to close the gap and advance international negotiations
• Robust scientific policy advice that outlines the option space and identifies winners and losers is crucial