Overview of Carbon Pricing Instruments

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Modeling for Carbon Pricing Instruments

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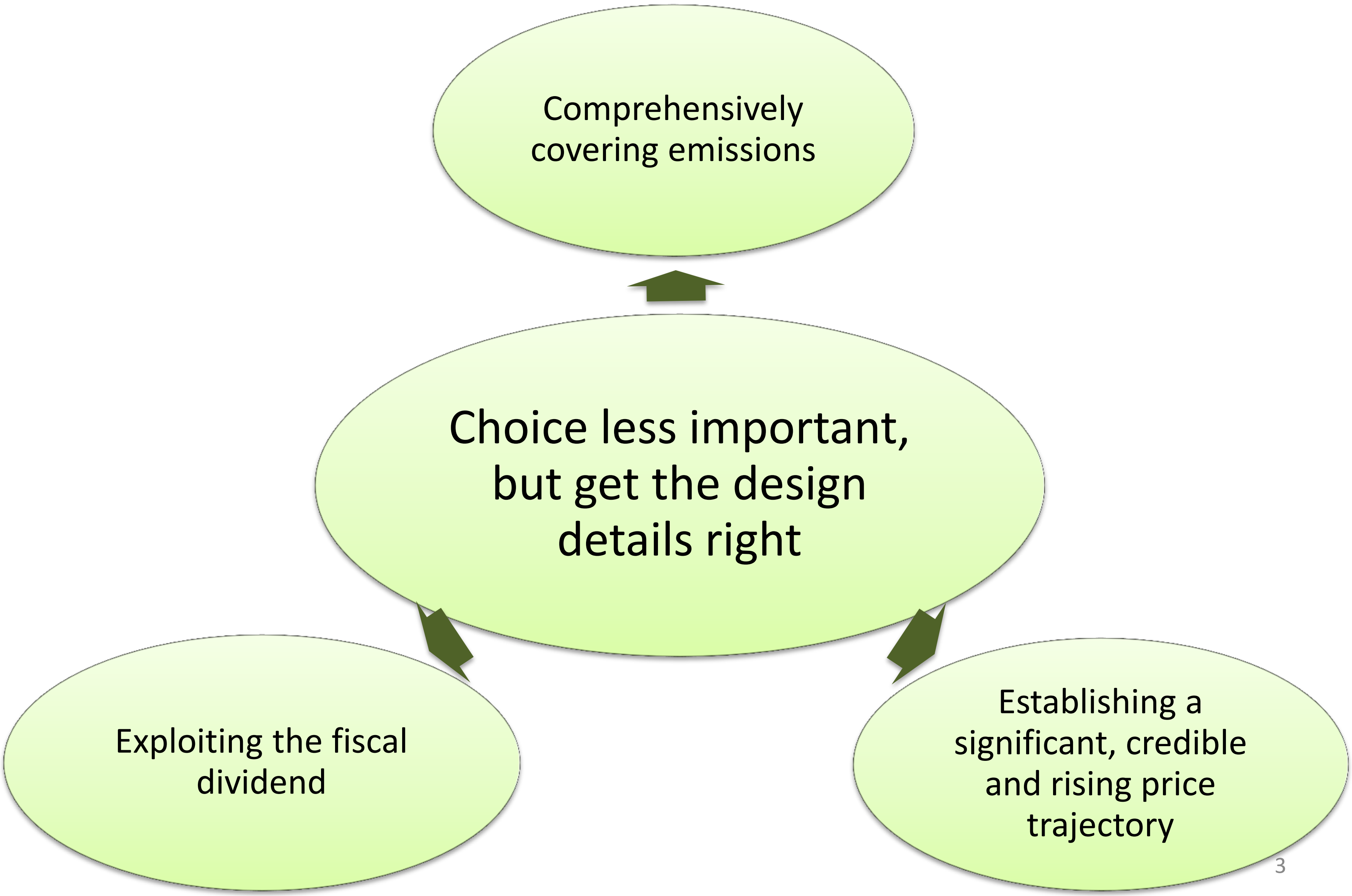
Views are authors' alone

Outline

- Rationale for carbon pricing instruments
- Modeling Issues

Carbon Taxes and ETS



Carbon pricing is the most effective policy…

Behavioral response	Carbon pricing
Fuel switching coal to natural gas	✓
Expanding renewables	✓
Expanding other zero-carbon fuels	✓
Reducing electricity demand	✓
Improving vehicle fuel economy	✓
Reducing driving	✓
Reducing heating fuels	✓

- But important to cover all sectors and to price emissions directly.

Other instruments are less effective…

- Energy taxes: e.g. taxes on electricity mitigate only indirectly (by reducing electricity demand)
- Regulatory approaches: e.g. incentives for power generation through renewables (does not encourage fuel switching, weak impact on electricity demand, does not reduce emissions outside of power sector)

Pricing instruments are cost effective

- Equate incremental costs of reducing emissions across firms, sectors, households

- BUT important to exploit fiscal dividend (1% of GDP in US, 2.5% of GDP in China)
  - use revenues to cut taxes on work effort and investment or for socially desirable spending
  - if revenues not used to increase economic efficiency, cost effectiveness seriously undermined
  - modeling analysis is important to enable better understand extent of potential fiscal dividend (i.e., revenues from C-tax or auctioning of emission permits)

Pricing instruments can raise revenue, but should not be a reason to set high prices

- Carbon prices should be set to reflect environmental damages, with broader revenue needs from broader instruments (e.g., VAT, personal income taxes).

Stable price trajectory important to…

- Equate the costs of incremental abatement in different years
- Conducive to investment in clean technologies
- Stable revenues

- How to limit price volatility in ETS?
  - e.g. allow to bank and borrow allowances
  - e.g. introduce a price collar

Modeling Issues

Value of Modeling

- *Provides information about*:
  - Emissions
  - Revenue
  - Energy prices
  - Distributional incidence—across households, firms
  - Evolution of energy sector (to guide investments)

- *Trade offs between alternative policy designs*

Useful Modeling Exercises (1)

- Coverage—compare policies with uniform price on all CO_2 with:
  - Policies with lower (or zero) prices for some emissions
  - Broader policies (e.g., non-CO_2 GHGs, forestry emissions, offsets)

- For carbon tax, alternative price levels, e.g.,
  - \$25/ton CO_2 (US government, 2010)
  - \$40/ton CO_2 (≈consistent with $3^{O}C$ target)

- For ETS, price impacts of alternative emissions targets under different scenarios and price stability provisions

- Competitiveness and leakage impacts: compare international coordination with
  - Unilateral action + leakage/compet. mitigation measures

Useful Modeling Exercises (2)

- Analyze impacts of other policies, e.g. renewables/energy efficiency policies
  - Reduce emissions under carbon tax
  - Reduce emissions prices and revenue under ETS
  - Model needs to decompose responses (e.g., fuel economy vs. mileage components of gasoline elasticity)

- Role of complementary policies in addressing other market failures, e.g.:
  - Reluctance to make clean energy investments due to spillovers, uncertainty over payoffs

Use of Complementary Models

- Analytical (implemented in spreadsheets)
  - Explicit formulas to make transparent the contribution of underlying parameters to costs and impacts of policies
  - Helps interpret, and serves as check on, computational models
- Computational
  - More accurate predictions
  - Illustrate dynamics (low emission transition paths)
  - More detail at industry level
- Input/output
  - Impacts on different product prices
  - With CES data for household budget shares→ distributional impacts
- Models of broader fiscal system
  - Impacts of alternative ways to recycle revenues

But Models Must

- Have realistic assumptions:
  - Future projections (e.g., energy prices, technology costs)
  - Response to policies (e.g., fuel price elasticities)

- Provide sensitivity analysis for different projections, parameter scenarios

- Trade off between transparency/sensitivity analysis and complexity

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