



Politics and Economics  
of Second-Best  
Regulation of  
Greenhouse Gases:  
The Importance of  
Regulatory Credibility

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# Motivation

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- Traditionally (e.g. IPCC), estimates of climate policy costs are based on a first-best world
  - immediate participation of all countries
  - perfect foresight
  - full basket of abatement options
  - global carbon market
- The UNFCCC process has shown how real-politik will diverge by far from first-best settings
- Question of interest: how does departing from such a first-best setting affect policy costs, energy investments, innovation ?

## Related Research

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- RECIPE (CIRED, FEEM, PIK): looks into delayed global action (crucial) and participation (first mover advantages) and energy technology availability.
- EMF 22 (10 IAMs): looks into delayed participation and policy anticipation (EPRI and FEEM).
- EMF 24 will be on technologies
- Big focus of IPCC 5th AR WGIII on second best features

## Climate Policy Costs depend on:

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- Stringency of Target
- Abatement Required (No Policy case)
- Model type (flexibility, abatement options,...)
- Assumptions about availability of technologies or abatement options (BECCS, REDD, ...)
- Assumptions about Policy (Optimal carbon tax or global trade, level of global inaction, level of participation, sectors covered, credibility)

# The Analysis

- We begin by describing two reference scenarios:
  1. a standard “business as usual” scenario with no regulation
  2. a “first best” scenario in which all countries make comparable efforts to stabilize atmospheric concentrations of CO<sub>2</sub> only at 450ppmv (roughly 535 CO<sub>2</sub>eq).
    - Firms have perfect foresight, all governments participate, all sectors are included, and unfettered trade allows equalization of costs.
    - Abatement effort is allocated across countries on the basis of **equal marginal costs** (to minimize the flows of emission permits when the market equilibrates).
- **The rest of the paper wreaks havoc on that optimal world.**

# The Numerical Tool/1

WITCH is a climate-energy-economy model designed to assist in the study of the socio-economic dimensions of climate change.

We model

## *1. Geometry of participation:*

- Emission caps for each region are imposed in different time periods. Countries moving first have to make up for extra emissions by non-participating countries.

## *2. Limited Trade:*

- Limits on the share of abatement that countries can buy on the market are imposed

## *3. Limited Sectors:*

- Emission caps are imposed on emissions coming from different sectors differently.

## The Numerical Tool/2

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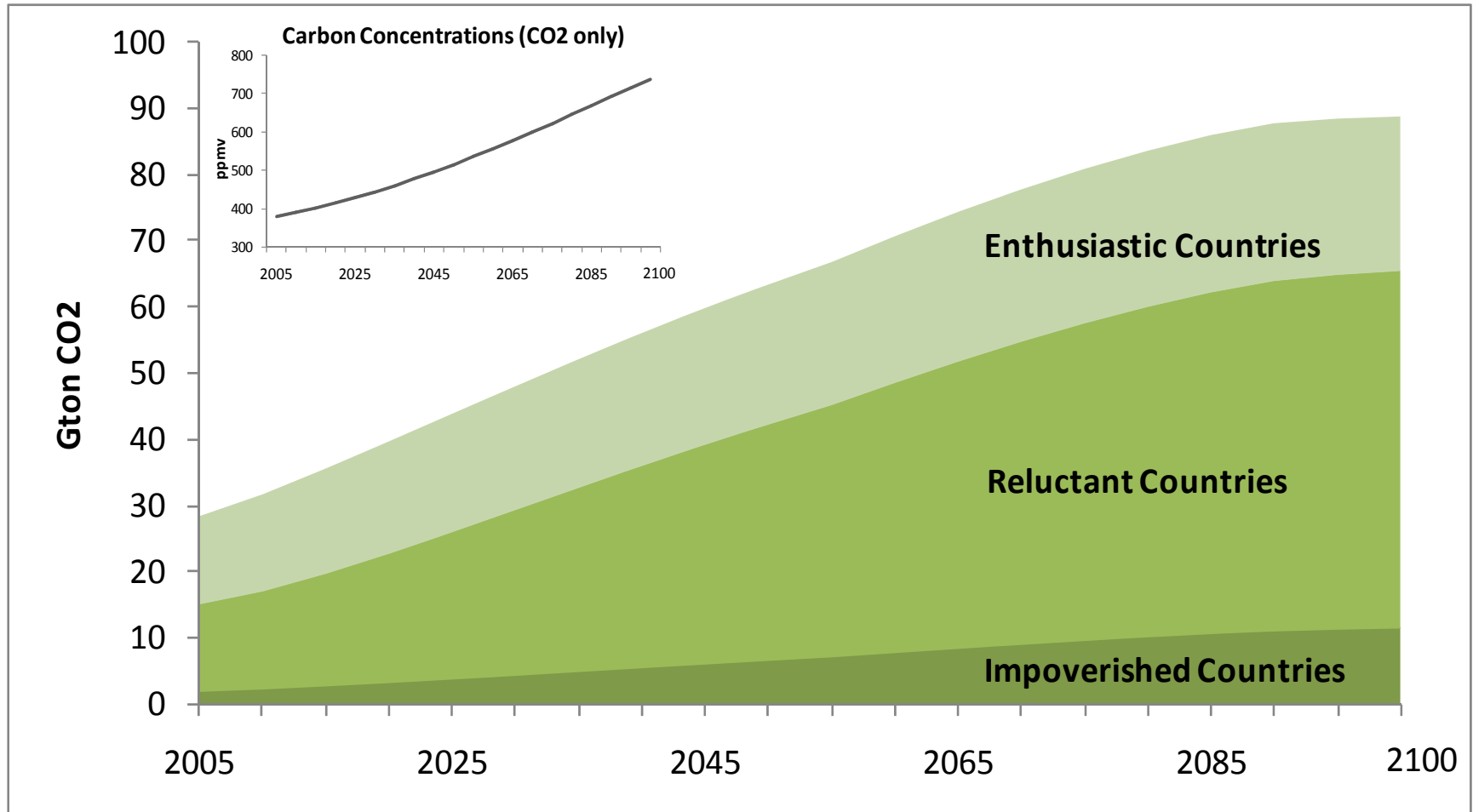
4. *Credibility (Policy Anticipation)*: WITCH assumes governments and firms are forward-looking. If policy is credible then governments (and firms) anticipate its arrival. We vary the time horizon over which investors can look to the future as a proxy for credibility. When credibility is high the investor can see to the distant horizon and anticipate, in 2010, a policy that formally takes full effect in 2030. When it is low, the future is cloudy and anticipation is reduced to 15, 10 or 5 years ahead of the policy.

# The Regional Aggregation

1. The “**enthusiastic**” nations (OECD countries) are under internal political pressure to spend their own resources to control emissions while also shifting some resources to other countries to help them with the task
2. The “**reluctant** countries” (BRICs, Transition Economies and Oil Exporting Countries ) are all headed in that same direction, although at present they are much less keen to devote their own resources to slowing global warming. Over time these nations will become less reluctant as higher wealth leads these societies to put more of a value in the amenity of a clean environment.
3. And last, we call the rest of the poorest countries “**impoverished**” (Africa and South East Asia). They are so poor that for the foreseeable future these countries will not be willing or able to control emissions.



# BaU: NO-Policy scenario

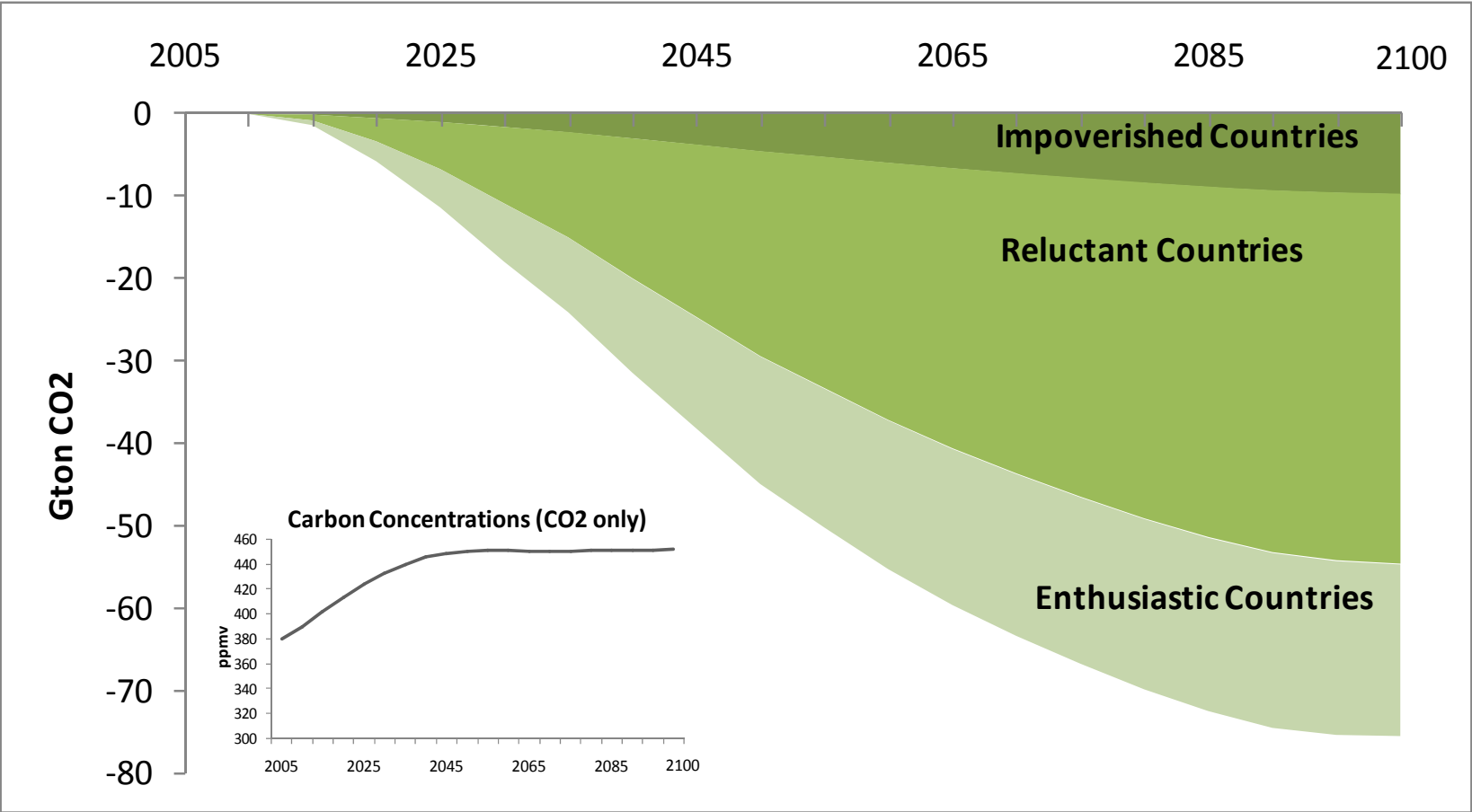


Three politically-informed groups of countries: the **enthusiastic** (rich, industrialized) nations, the **reluctant** nations that are fast-growing yet wary at present to spend their own resources on emission controls, and the **impoverished** low-emission countries that have other priorities for the coming decades and are not immediately essential players in emission controls. The inset shows projections for CO<sub>2</sub> concentrations (including land-use emissions).

## Assuming a First-Best World

- All countries stabilize atmospheric concentrations of CO<sub>2</sub> only at 450ppmv (roughly 535 CO<sub>2</sub>eq).
- Firms have perfect foresight, all governments participate, all sectors are included, and unfettered trade allows equalization of costs.
- Abatement effort is allocated across countries on the basis of **equal marginal costs** (to minimize the flows of emission permits when the market equilibrates).

# Abatement Efforts in the “First Best” world of optimal regulation



Main chart shows emission levels (below the BAU scenario) for each of our three groups of countries. The inset shows the resulting stabilization of CO2 concentrations

## Emission reductions to achieve 450 ppm

	Enthusiastic countries (OECD countries)	Reluctant countries (BRICs, Transition Economies and Oil Exporting Countries )	Impoverished countries (Africa and South East Asia)
Power Sector	76%	83%	82%
Other Energy Sectors	57%	52%	57%

## Policy Costs in the First-Best World

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The cost of such an optimal policy—what we also call the “first best world,”--measured in the loss in Gross World Product (GWP) compared with the BAU scenario, is 1.58% using a 5% discount rate.

## Variable Geometry

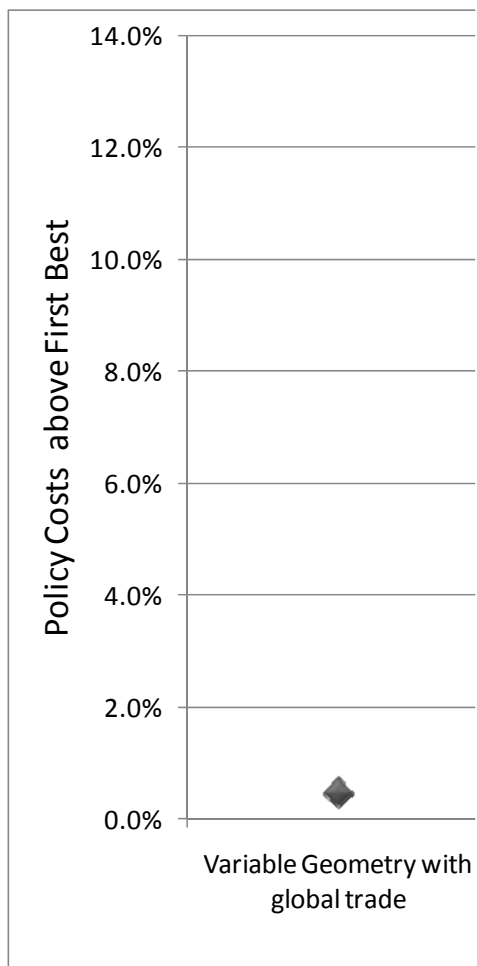
- All countries stabilize atmospheric concentrations of CO<sub>2</sub> only at 450ppmv (roughly 535 CO<sub>2</sub>eq).
- Firms have perfect foresight, **governments participate at different type periods**, all sectors are included, and unfettered trade allows equalization of costs.

# Variable Geometry/1

Country	Target	Example
Enthusiastic countries (OECD countries)	Immediate target. Allocation proportional to effort in first best case	For US. By 2025 30% below baseline and 24% above 1990 levels. By 2050 77% below baseline and 49% below 1990 levels.
Reluctant countries (BRICs, Transition Economies and Oil Exporting Countries )	Target in 2030. Allocation proportional to effort in first best case	China. By 2050 70% below baseline and 108% above 1990 levels.
Impoverished countries (Africa and South East Asia)	Target in 2050. Allocation proportional to effort in first best case	Sub-Saharan Africa. By 2050 75% below baseline and 61% above 1990 levels.

After 2050 all nations converge to make a comparable effort (naïve assumption as e.g. Africa was deeply poor a century ago and might still rank among the impoverished in 2100, but our concern here is the transition until 2050)

# Variable Geometry/2





## Variable Geometry/3

- There is a burgeoning literature on the geometry of participation, and much of it explores scenarios with similar attributes [See, e.g., Bosetti et al 2008; Edmonds et al., 2007; Keppo and Rao, 2007, Clarke et al 2009, Jacoby et al, 2008].
- Our results for this simple, variable geometry scenario are similar to those reported in other studies: assuming immediate and unlimited global trading including offsets, **global policy costs are basically the same as in the first best world** because trade allows for easy equilibration of markets and least-cost solutions.
- The **cost for individual regions varies** with the assignment of regulatory burdens. In our variable geometry scenario, the enthusiastic countries incur 8% extra burden than in our first best scenario; reluctant countries 5%; and the impoverished countries are 49% better off because they sell surplus permits and investment opportunities in offsets to the other countries that have tighter regulation.

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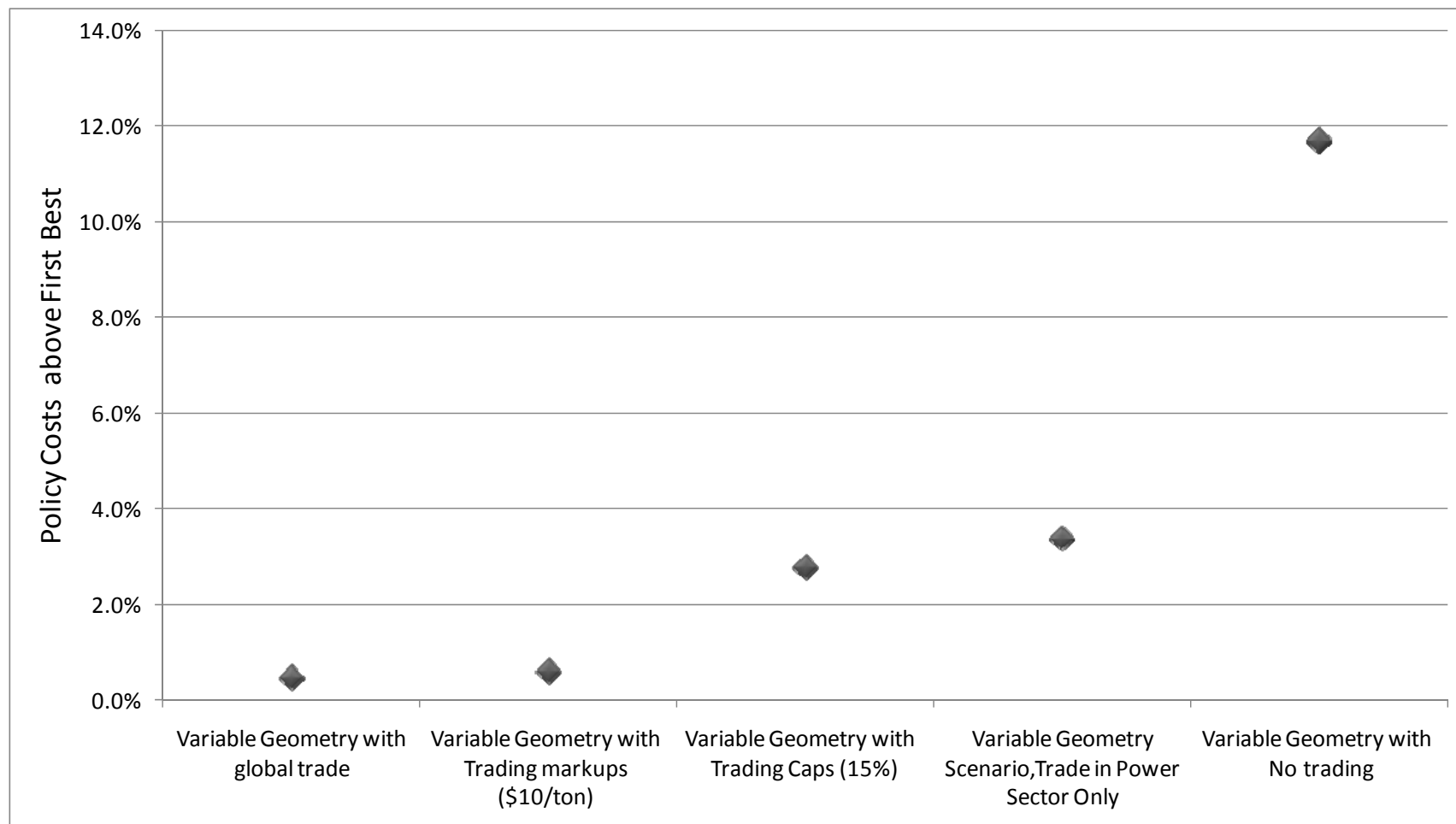
## Trade and Sectors

- All countries stabilize atmospheric concentrations of CO<sub>2</sub> only at 450ppmv (roughly 535 CO<sub>2</sub>eq).
- Firms have perfect foresight, **governments participate at different type periods, trade or sector coverage are incomplete.**

# Trade and Sectors/1

- We model bans or caps on trade between regions, which could reflect the desire to limit the flow of capital and to force regulation to occur within particular countries.
- We consider different cases:
  1. **No Trading**
  2. **Trading Caps** (all sectors and all groups of countries participate from the beginning to the global market but there is a 15% limit on the share of permits over total abatement)
  3. **Trading Mark-ups** (all sectors and all groups of countries participate from the beginning to the global market but there is a \$10 markup on the price of permits to reflect higher administrative costs)
  4. **Trading in power sector only** (only the power sector of reluctant and impoverished countries is linked to the global market, until they get a binding target)

## Trade and Sectors/2



## Trade and Sectors/3

- These results are consistent with other scholars who have found that **so long as some form of trade is allowed for, extra costs** imposed by different form of trading constraints **are modest**
- The effect on global costs of allowing **trade in the power sector only is also limited** and shows that a power-focused regulation would not impose large efficiency losses.
- The extra cost, however, is small because most of reduction that would be bought and sold on the market come from the power sector even when all sectors are accounted for, as the non electric sectors (notably transportation) are more costly to regulate.

## Trade and Sectors/4

- What makes an important difference between the different trade scenarios is **the magnitude of financial flows across countries.**
- Over the period 2010-2025 the cumulated financial flow wrt the unlimited trade case is:
  - 26% when power sector is the only regulated sector,
  - less than 10% when there are trading caps.
- **Limits on trading that have a modest impact on total cost can have a huge impact on reducing politically toxic financial flows.**

## Credibility

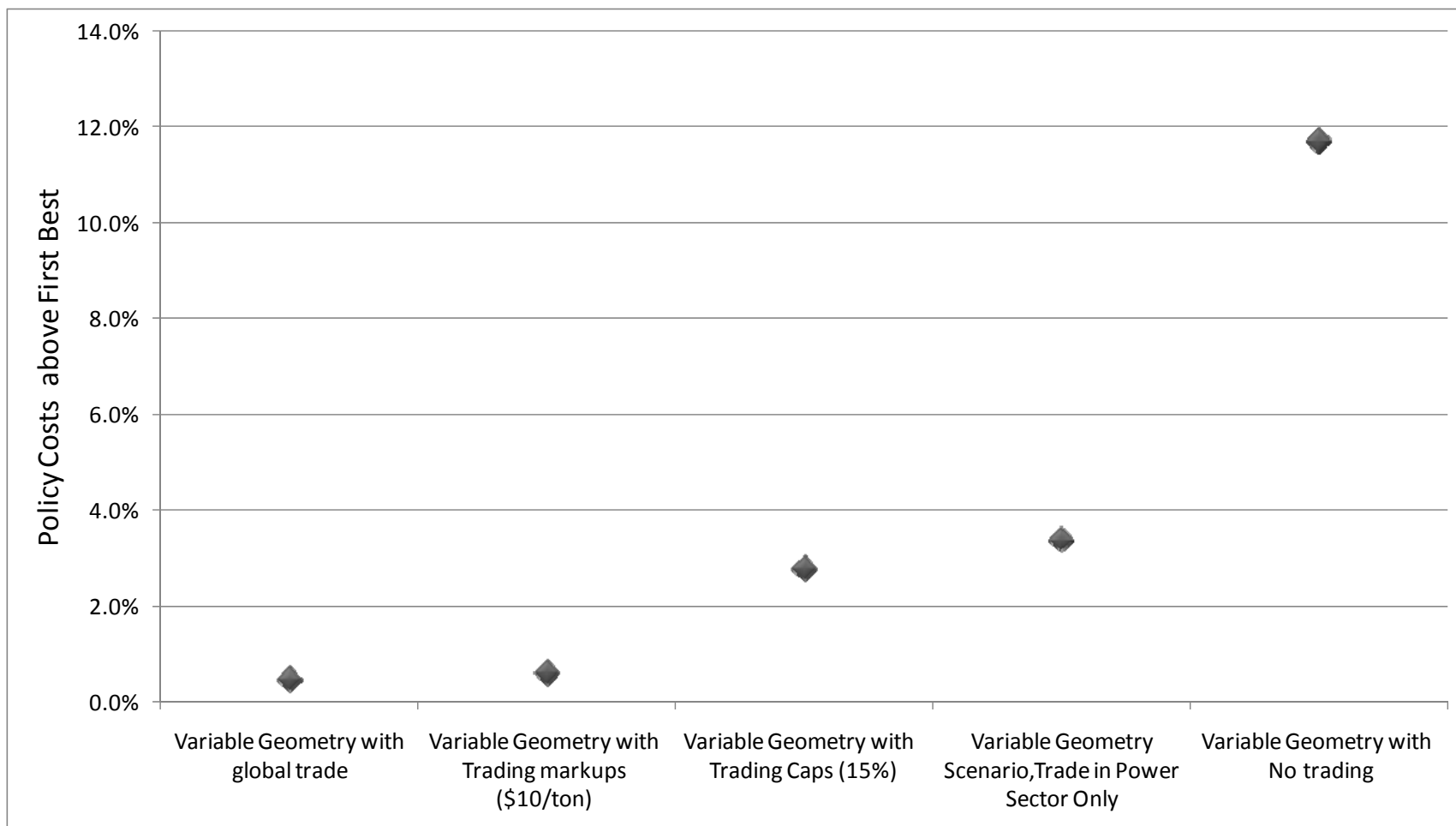
- All countries stabilize atmospheric concentrations of CO<sub>2</sub> only at 450ppmv (roughly 535 CO<sub>2</sub>eq).
- **Firms have increasingly imperfect foresight, governments participate at different type periods, no trade is allowed.**

# Credibility and Anticipation/1

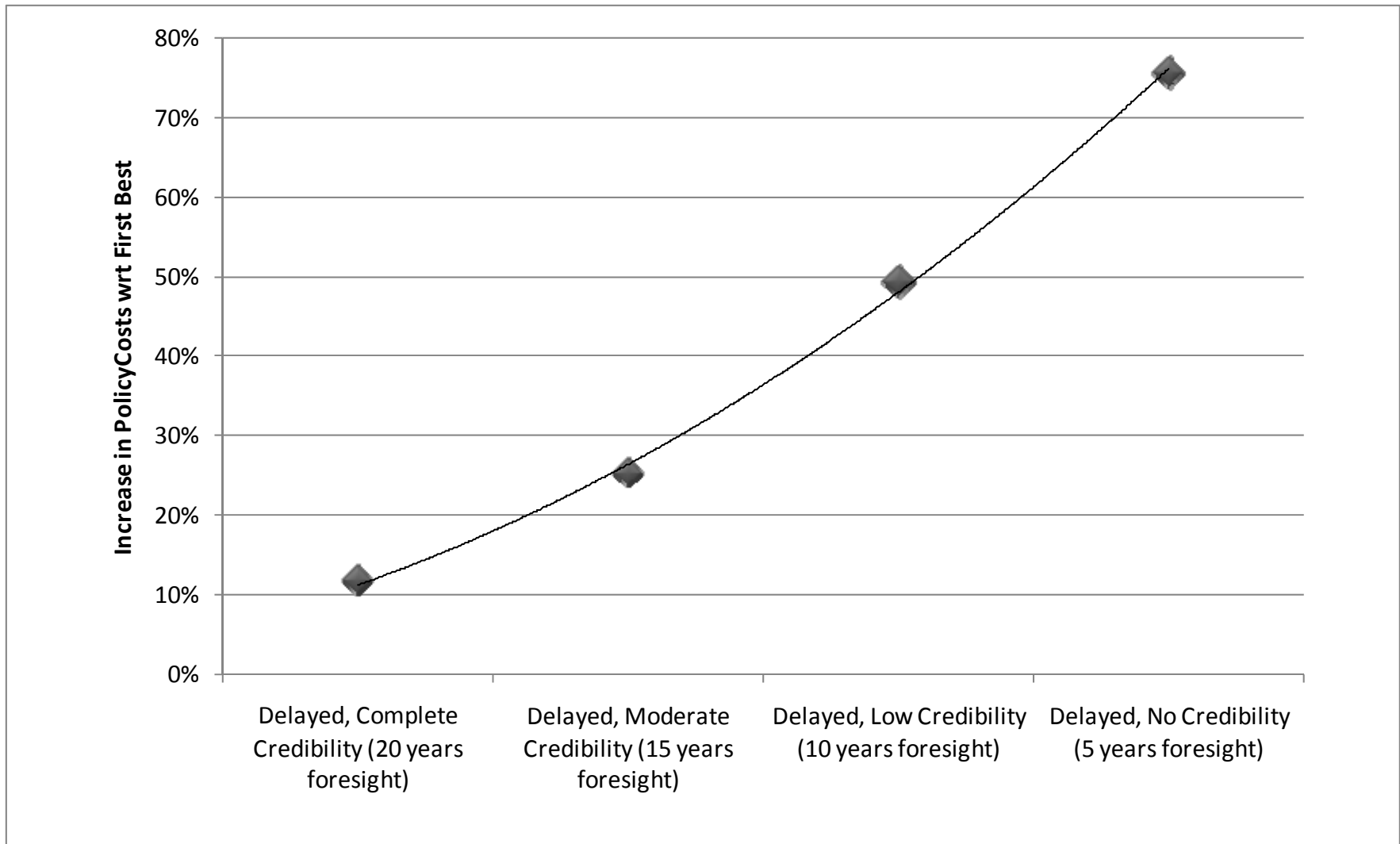
- Even the most ardent enthusiasts of **international law** do not see those regulatory instruments as **such reliable guides for investment** when compared with the strict system of planning, monitoring and enforcement that is typical of a well-administered system and enforced scheme of national law.
- To explore the importance of credibility we vary the extent to which the **model allows foresight**.
- We start with a standard assumption of perfect foresight. (This assumption is akin to imagining that information about the future is costless to obtain.) Then we make the future progressively cloudier—and more realistic—until we reach a scenario of “no credibility,” which allows for a 5 year foresight.



# Credibility and Anticipation/2

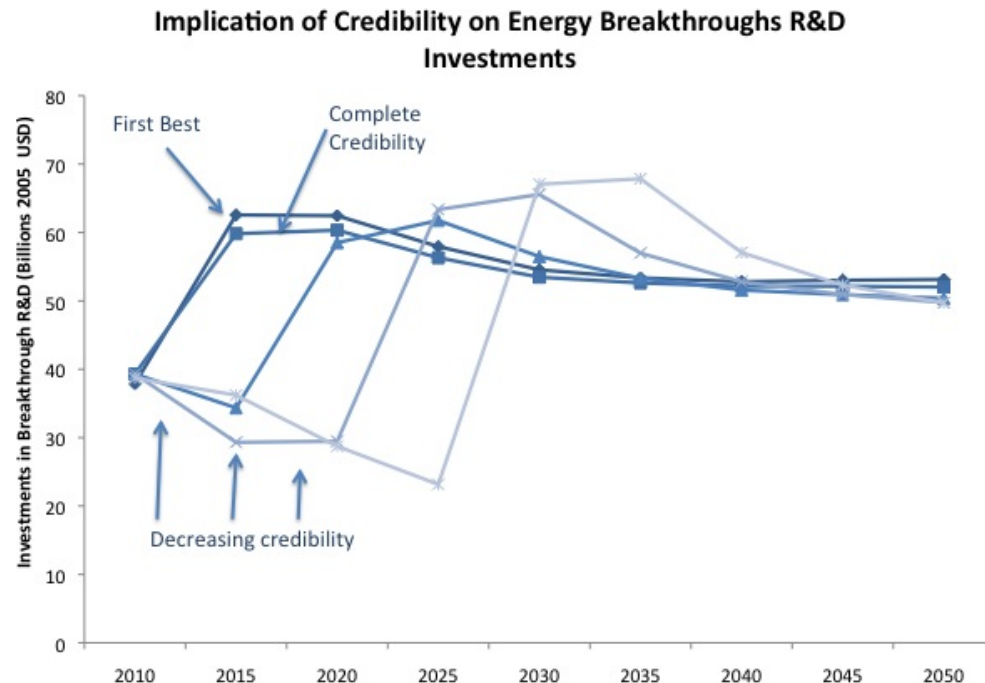


# Credibility and Anticipation/2



## Credibility and Anticipation/3

- As credibility declines, the **policy cost** (which we measure as the percentage increase in world regulatory cost compared with the first best scenario) **rises sharply**.
- One driver of higher costs is that when policies are not credible governments do not spend money on **R&D** until the policy appears—at which point investment surges, although total investment (undiscounted) is lower in incredible scenarios than in the credible ones.



## Policy Implications

- One strategy to boost credibility involves **shifting from global negotiations**, which are often ponderous because it is hard to get 200 nations to agree on anything, **to smaller “clubs”**.
- Another is to invest heavily in **building institutions** that make it easier for countries to negotiate commitments, monitor behavior, and stabilize expectations.
- A third strategy is **pre-commitment**: a country can boost the credibility of international warming regulations on its own soil by committing to cut emissions even in advance of a binding international obligation. Pre-commitment can be in the self-interest of countries

## Why pre-commitment makes sense

	<b>Enthusiastic countries (OECD countries)</b>	<b>Reluctant countries (BRICs, Transition Economies and Oil Exporting Countries)</b>	<b>Impoverished countries (Africa and South East Asia)</b>
<b>Variable Geometry, Complete Credibility (Increase in Policy costs wrt First Best)</b>	<b>33%</b>	<b>10%</b>	<b>-49%</b>
<b>Variable Geometry, No Credibility (Increase in Policy costs wrt First Best)</b>	<b>114%</b>	<b>75%</b>	<b>-47%</b>
<b>Efficiency Gains from Credibility (trillions of 2005 USD, discounted 5%)</b>	<b>9.4</b>	<b>11.9</b>	<b>0.1</b>

## Concluding remarks

- Second-best analysis will be at the basis of more accurate assessment of policy costs and optimal climate policies (see also IPCC 5th AR). **Accounting for imperfect policy features makes a difference.**
- We find that the aspect of the second best that has commanded most analytical attention—**variable geometry**—has **strikingly small effect** on the overall economic efficiency of a global warming regime as long as there is a global carbon market.
- **For cuts in emissions much deeper than those analyzed here, such second best geometries might be more important.**
- **Trade limitations have also modest effect**, but could decrease the financial transfers implied by fairer allocations (by varying geometry we recognize that less wealthy countries will delay their participation).
- By contrast, the ability of firms and governments to **anticipate credible regulations has a massive impact on cost** (the impact is comparable in magnitude to that of some key abatement options).
- Variables such as **the investment in international institutions** might be added explicitly to integrated assessment models as an endogenous factor to control for the capability of anticipating future policies.

