



International Climate Mitigation Regime Beyond 2012: How Do Quota Allocation Rules Perform Under Uncertainty?

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Context

Stabilizing GHG concentrations requires ultimately that the U.S. and developing countries control their emissions.

Two major obstacles:

- One generic: distributional issues associated with burden sharing
- One specific to quantity-based approach under uncertainty: Parties negotiate on **quantities** but care about **costs**, and **uncertainties make costs of reaching a given target uncertain.**

Questions

- Since it is likely that the post-Kyoto regime be quantity-based, isn't there a risk that uncertainty on baseline hamper agreement?
- Among the various quota allocation rules (QARs) that have been proposed in the literature, are some more robust to uncertainties on baseline and abatement costs than others?

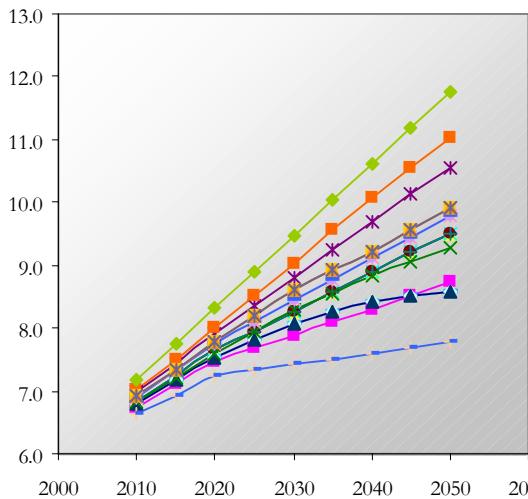
Methodology

- Partial equilibrium model of the allowance market with:
 - 12 regions, each with own marginal abatement cost curve (EPPA derived)
 - 9 five-year commitment periods from 2008 to 2052
 - Solved sequentially under various QARs, and various baseline scenarios, covering a wide range of plausible futures.

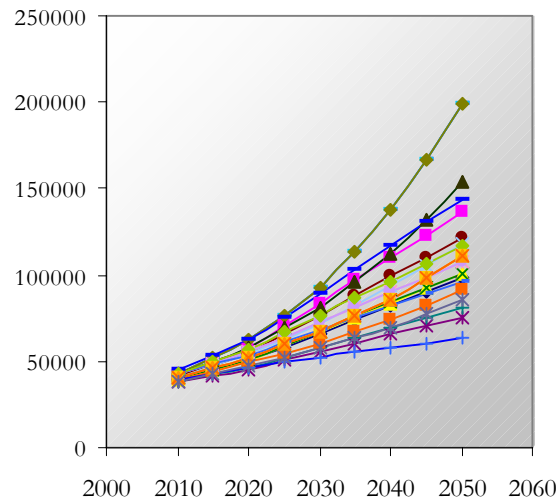
A focus on Baseline Uncertainty

- 21 baseline scenarios for CO2 emissions, but also population and GDP (necessary for QAR computation)
- Representative of range of uncertainty in SRES report.

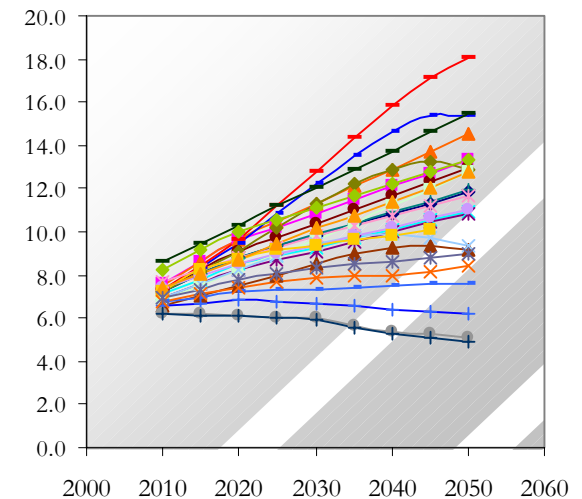
World Population



World GDP



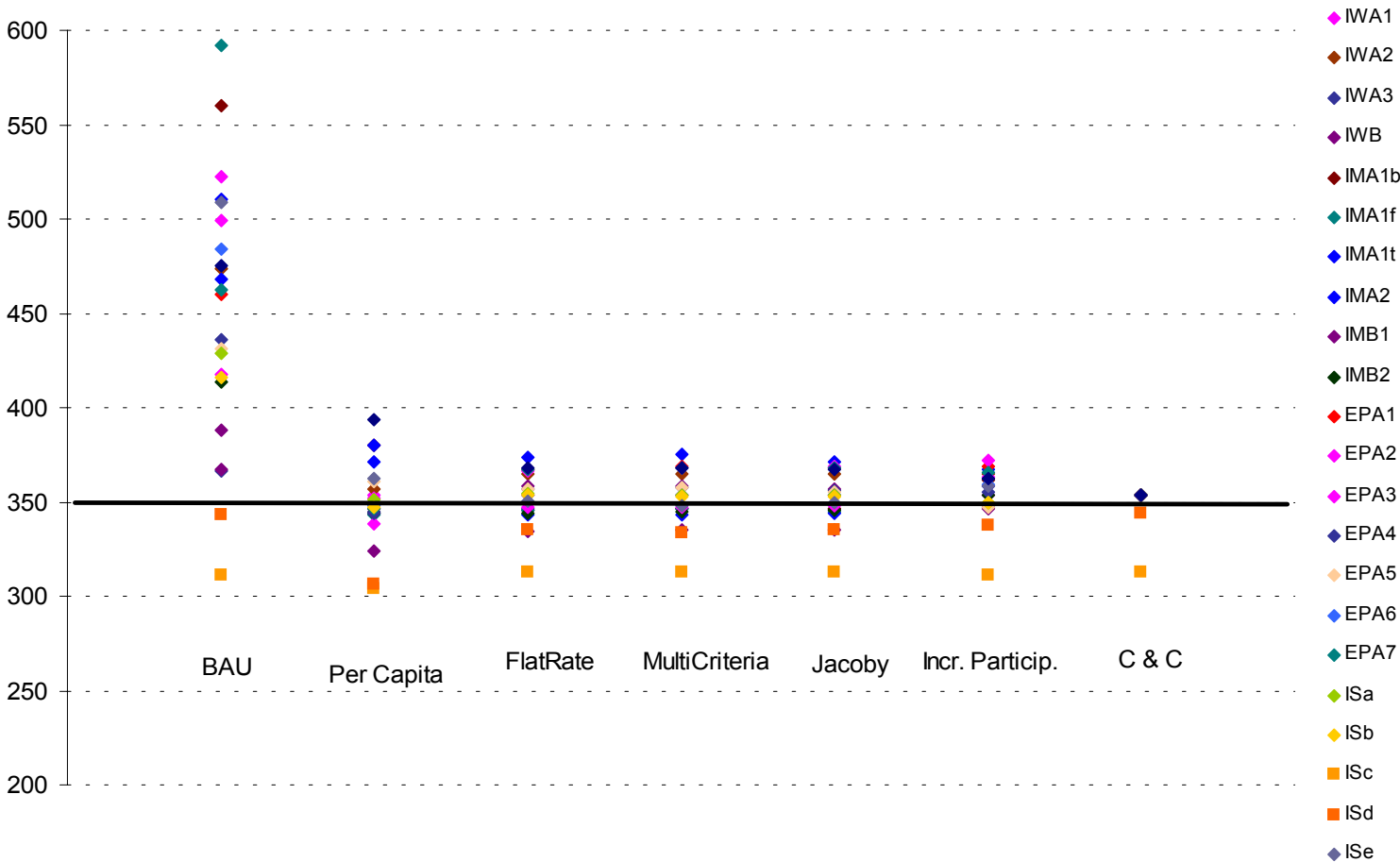
World CO2 Emissions



Selected Quota Allocation Rules

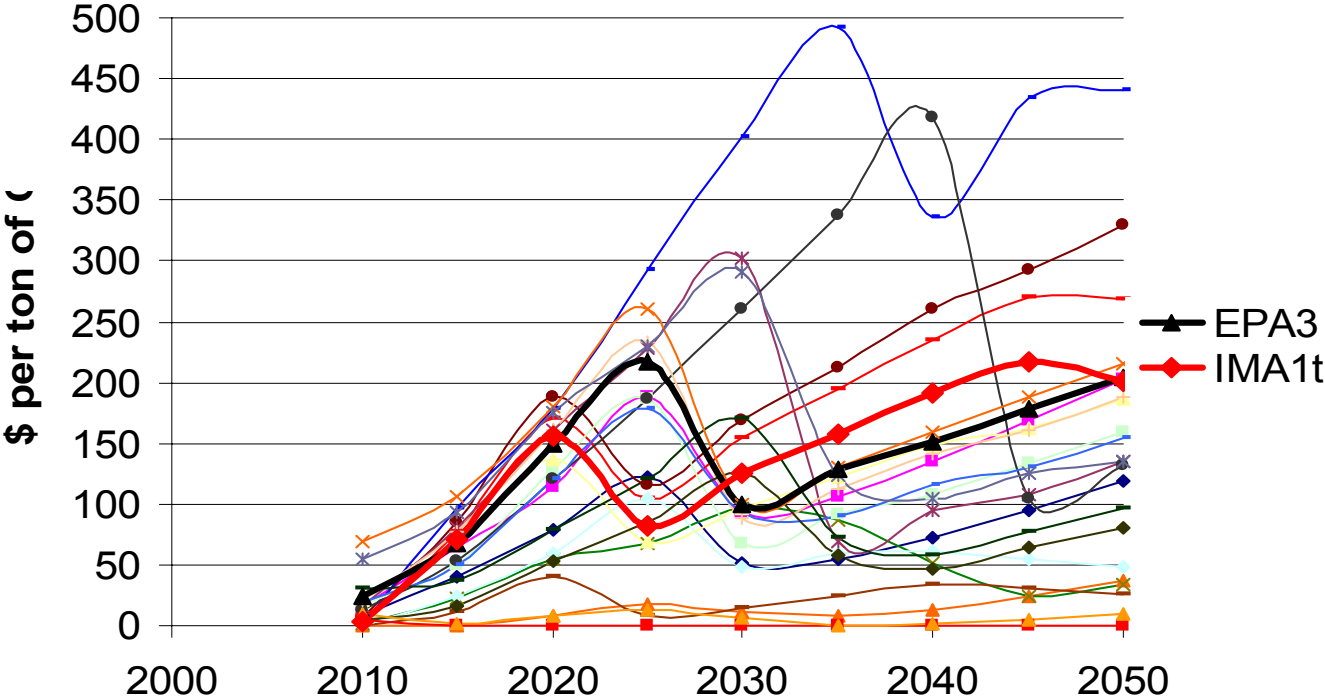
- **‘Grandfathering’ family:**
 - Flatrate
 - Multicriteria (Norwegian proposal)
 - GDP-indexed rate (H. Jacoby’s proposal, MIT)
- **‘Per Capita’ entitlements:**
 - Immediate Per Capita (Agarwal and Narain, 1991)
 - Contraction and Convergence (GCI)
- **Responsibility approach**
 - Adapted Brazilian proposal: Increasing Participation (RIVM)

Imperfect Control of Quantities



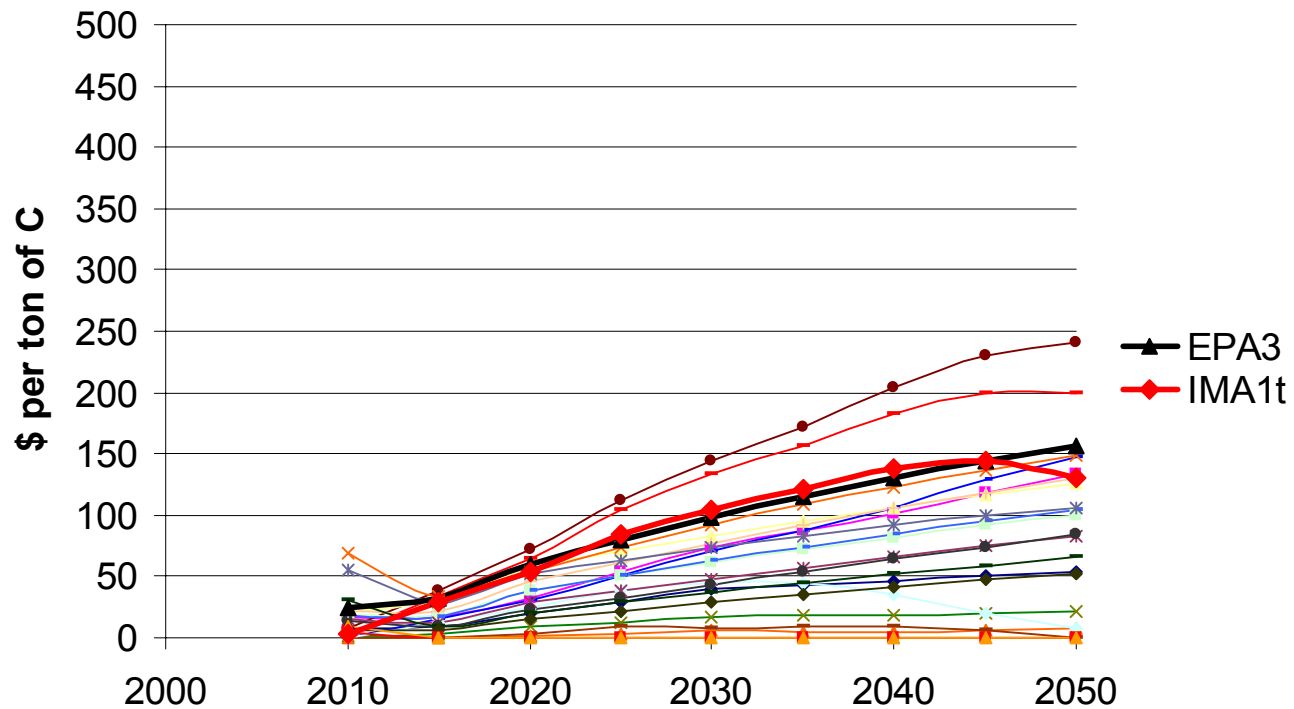
Dynamic uncertainties

Carbon Price - Jacoby's rule

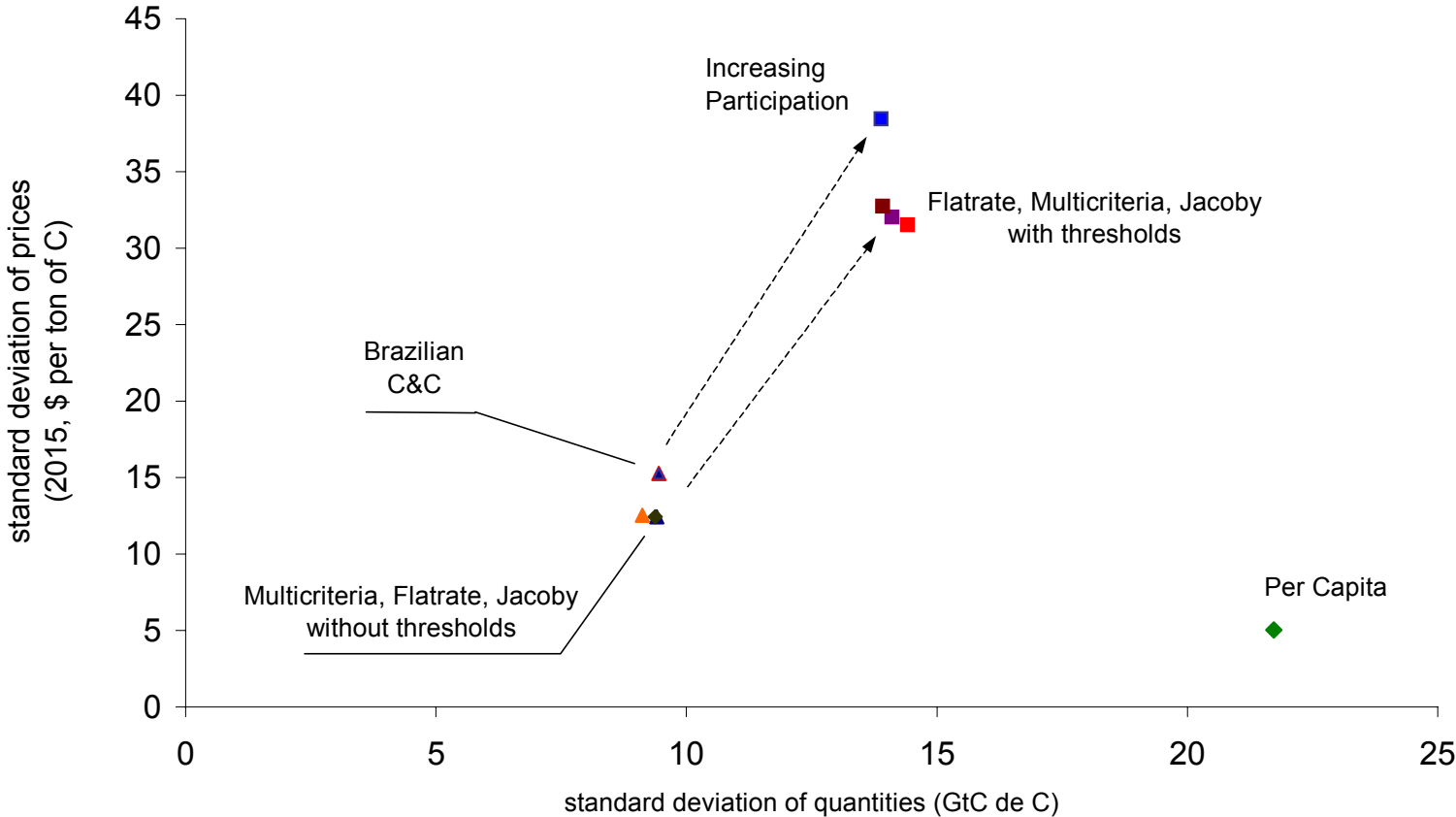


A Static Threshold is not innocuous

Carbon Price - Jacoby's rule



Uncertainties Magnified by a Threshold ?



Early Entry of DCs has a predominant impact on world total costs

- Early entry of Developing Countries supply early cheap abatement opportunities and lower total world costs for all scenarios.
- When a less stringent global constraint on quantities is due to later entry of DCs, it does not appear to be sufficient to lower prices in compensation to the absence of cheap abatement opportunities

Is a Threshold a 'misleading' good idea ?

Calling for threshold for entry of developing countries in the regime is based on a combination of economic and pragmatic arguments.

- Ability to pay / Basic needs
- Willingness to pay – Clean atmosphere as a superior good

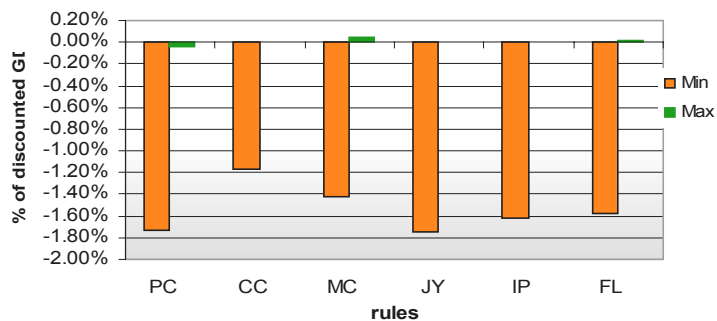
However:

- it magnifies uncertainties on prices
- it is likely to increase total world costs of mitigation

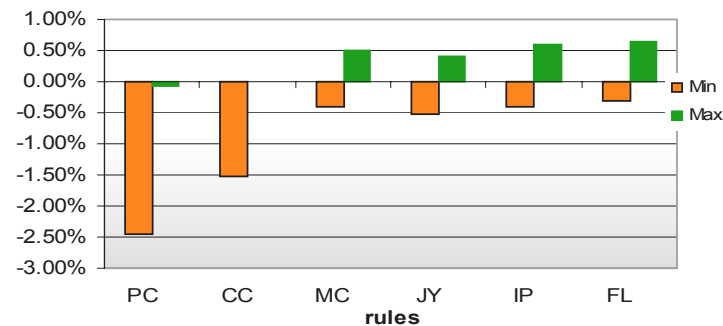
But alternative types of threshold still have to be tested

Total Costs Remain Highly Uncertain under All Rules

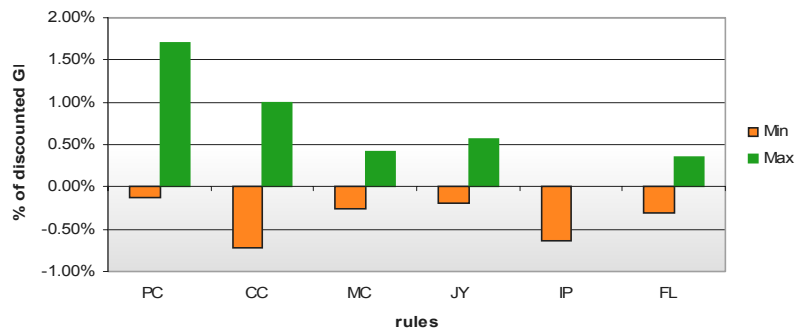
Total discounted costs 2015-2030
Western Europe



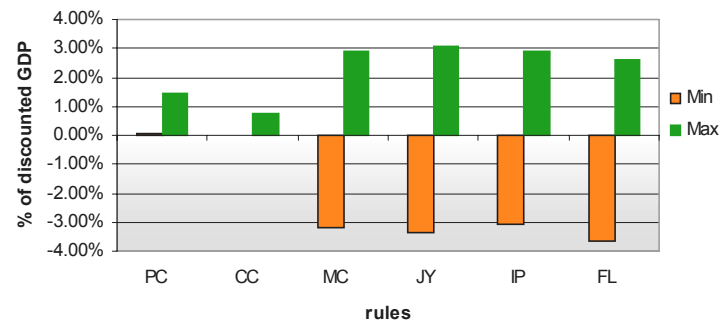
Total discounted costs 2015-2030
USA



Total discounted costs 2015-2030
Centrally Planned Asia



Total discounted costs 2015-2030
Latin America



Least-Costs Choices across Rules are scenario-dependent for some Regions

(2015-2030)

	USA	CANZ	JPN	WEU	EEU	FSU	CPA	SAS	ROA	MENA	SAFR	LAM
IWA1	FL	IP	CC	MC	JY	OUT	JY	CC	CC	CC	CC	CC
IWA2	FL	IP	CC	MC	JY	OUT	JY	CC	CC	CC	CC	CC
IWA3	FL	IP	MC	MC	JY	OUT	JY	CC	JY	CC	CC	CC
IWB	FL	IP	MC	MC	JY	OUT	CC	CC	CC	CC	CC	CC
IMA1b	IP	IP	IP	CC	JY	JY	JY	CC	CC	CC	CC	CC
IMA1f	IP	IP	CC	CC	CC	JY	JY	CC	CC	CC	CC	CC
IMA1t	IP	IP	CC	CC	CC	JY	JY	CC	CC	CC	CC	CC
IMA2	FL	IP	CC	CC	JY	OUT	CC	CC	CC	CC	CC	CC
IMB1	FL	IP	CC	CC	CC	JY	JY	CC	JY	CC	CC	JY
IMB2	FL	IP	IP	MC	JY	JY	JY	CC	CC	CC	CC	CC
EPA1	IP	IP	CC	CC	CC	JY	JY	CC	CC	CC	CC	JY
EPA2	IP	IP	CC	IP	CC	JY	JY	CC	CC	CC	CC	MC
EPA3	FL	IP	CC	CC	CC	JY	JY	CC	CC	CC	CC	CC
EPA4	FL	IP	CC	CC	JY	OUT	CC	CC	CC	CC	CC	JY
EPA5	FL	IP	CC	CC	CC	OUT	CC	CC	CC	CC	CC	IP
EPA6	FL	IP	CC	CC	CC	JY	JY	CC	CC	CC	CC	JY
EPA7	IP	IP	CC	CC	CC	OUT	JY	CC	CC	CC	CC	JY
ISa	FL	IP	CC	CC	JY	OUT	OUT	CC	CC	CC	CC	IP
ISb	FL	IP	CC	MC	JY	OUT	OUT	CC	CC	CC	CC	IP
ISc	IP	IP	FL	FL	FL	OUT	OUT	OUT	OUT	OUT	OUT	IP
ISd	JY	IP	CC	CC	CC	OUT	JY	CC	CC	CC	CC	JY
ISe	FL	IP	CC	CC	JY	JY	JY	CC	CC	CC	CC	CC
ISf	FL	IP	CC	CC	JY	OUT	OUT	CC	CC	CC	CC	CC

Two decision criteria lead to quite robust choices

Discounted costs up to 2030

	Mean expected	Minimax
USA	Flat Rate	Flat Rate
CANZ	Incr. Part.	Incr. Part.
JPN	C&C	C&C
WEU	C&C	C&C
EEU	Jacoby	C&C
FSU	Jacoby	OUT
CPA	Per Capita	Per Capita
SAS	Per Capita	Per Capita
ROA	Per Capita	Per Capita
MENA	C&C	C&C
SAFR	Per Capita	Per Capita
LAM	Per Capita	Per Capita

Discounted costs up to 2030 (without Per Capita)

	Mean expected	Minimax
USA	Flat Rate	Flat Rate
CANZ	Incr. Part	Incr. Part
JPN	C&C	C&C
WEU	C&C	C&C
EEU	Jacoby	C&C
FSU	Jacoby	Flat Rate / Jacoby
CPA	Jacoby	Jacoby
SAS	C&C	C&C
ROA	C&C	C&C
MENA	C&C	C&C
SAFR	C&C	OUT
LAM	C&C	C&C

- Strong oppositions re-appear as expected, even with uncertainties.
- Tables also suggest some room for negotiation:
'Earlier entry of developing countries in exchange for higher transfers from the North'

Choices evolve with the planning horizon

Mean Expected

	2015	2015-2030	2015-2050
USA	Flat Rate	Flat Rate	Flat Rate
CANZ	Incr. Part.	Incr. Part.	Incr. Part.
JPN	C&C	C&C	C&C
WEU	C&C	C&C	MultiCrit
EEU	Jacoby	Jacoby	Jacoby
FSU	OUT	Jacoby	Jacoby
CPA	C&C	Jacoby	Jacoby
SAS	C&C	C&C	C&C
ROA	C&C	C&C	C&C
MENA	C&C	C&C	C&C
SAFR	C&C	C&C	C&C
LAM	Jacoby	C&C	C&C

Minimum

	2015	2015-2030	2015-2050
USA	Flat Rate	Flat Rate	Flat Rate
CANZ	Incr. Part.	Incr. Part.	Incr. Part.
JPN	C&C	C&C	C&C
WEU	C&C	C&C	MultiCrit
EEU	C&C	C&C	Jacoby
FSU	OUT	Flat Rate	Jacoby
CPA	OUT	Jacoby	Jacoby
SAS	OUT	C&C	C&C
ROA	OUT	C&C	C&C
MENA	C&C	C&C	C&C
SAFR	OUT	OUT	OUT
LAM	C&C	C&C	C&C

Conclusion

- **Highlight 1:** Prices and transfers remain highly uncertain across scenarios
- **Highlight 2:** Rules of entry – especially thresholds – have a significant impact on the behaviour of QARs under uncertainty : prices and costs. What is the 'cost' of such specifications?
- **Highlight 3:** Choices among selected rules:
 - are quite robust to the attitude toward risk (decision criteria),
 - BUT sometimes evolves when the time horizon changes.

Further issues

Actually uncertainties don't change so much usual strong oppositions on burden sharing.

But uncertainties reveal two main issues:

- **Implementation:**

Stakeholders really need stable signals, or a safeguard
(price cap?)

- **Enlargement:**

Risk-adverse DCs may be deterred from entering
the market early by those uncertainties
(an other kind of guarantee of positive net benefit for DCs?)

Further developments

- **Track 1** : Refining the analysis with complementary mechanisms (price-cap, banking).
- **Track 2** : Considering regional damages to discuss international distribution issues.
- **Track 3** : Assessing Impact of Internal Policies on real costs and net benefits.

For more information

Lecocq, F., Crassous, R., International Climate Regime beyond 2012: Are Quota Allocation Rules robust to uncertainty ?, WorldBank Policy Research Paper #3000, March 2003.

Available on:

http://econ.worldbank.org/files/24950_wps3000.pdf