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Modeling Economic Impacts of Alternative International Climate Policy Architectures. A Quantitative and Comparative Assessment of Architectures for Agreement

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Key Messages/1

1. **TIME IS SHORT.** If an **agreement** involving effective global commitments by all **key parties** is not achieved by 2030, the stabilisation of temperature rise below a **safe level** by 2100 is **not a technically feasible** objective.
2. **COSTS IS NON LINEAR. Economic penalties** are driven by the **climate target** in a marked non-linear fashion: the first part of the emission reduction effort is fairly cheap. Ambitious targets require progressively increasing economic resources.
3. **TASK IS DIFFICULT.** As for the **environmental performance** of different Post-Kyoto agreements, only a small subset of the policies proposed is able to maintain temperature increase in 2100 below the 2°C target.

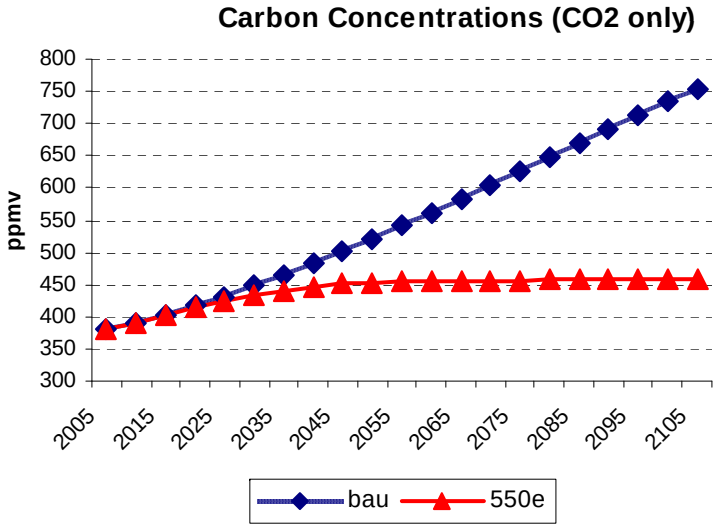
Key Messages/2

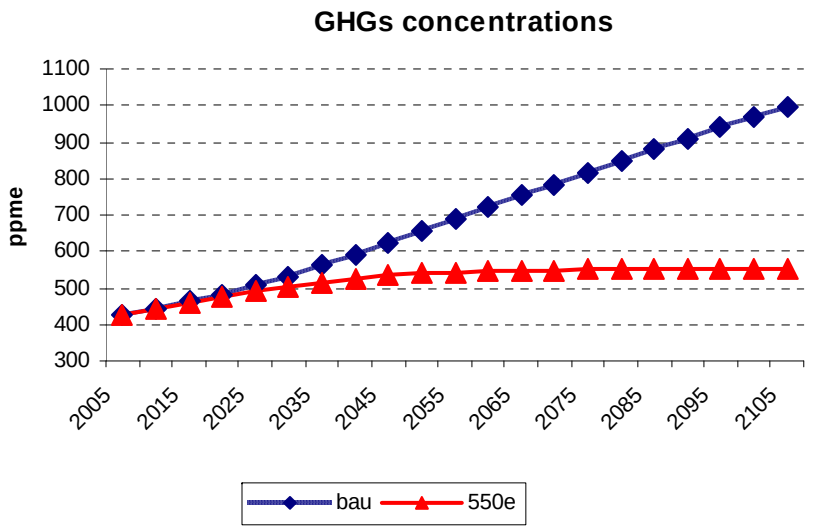
4. **MULTIPLE BENEFITS**. Potential to yield benefits in terms of distribution of income across regions. The magnitude of **equity** improvements depends on the **compensation mechanisms** assumed in the policy scheme.

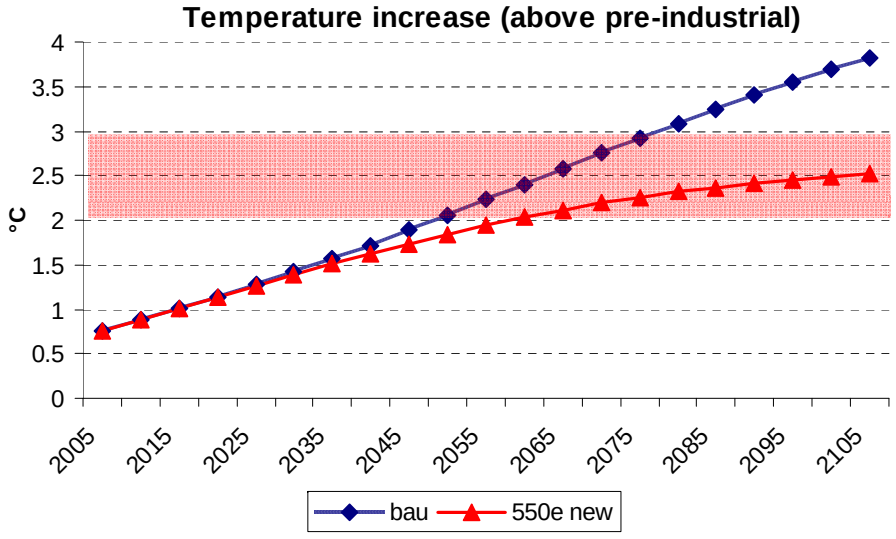
5. **COST CAN LOWERED.** For example, the inclusion of avoided deforestation (**REDD**) is shown to decrease the policy cost and thus to improve the enforceability of future agreements, as it provides additional incentives for participation to some developing countries.

6. **PRICE SIGNAL IS NEEDED**. Policies aiming at **R&D cooperation** that do not involve any carbon constraints or taxes, are shown to have a positive effect on economic activity, and are thus likely to be the only ones leading to a global, self-enforcing agreement. However, they have a very limited climate effectiveness, thus suggesting that R&D provisions are necessary but not sufficient elements of an effective climate policy.

Concentration of GHGs and temperature change







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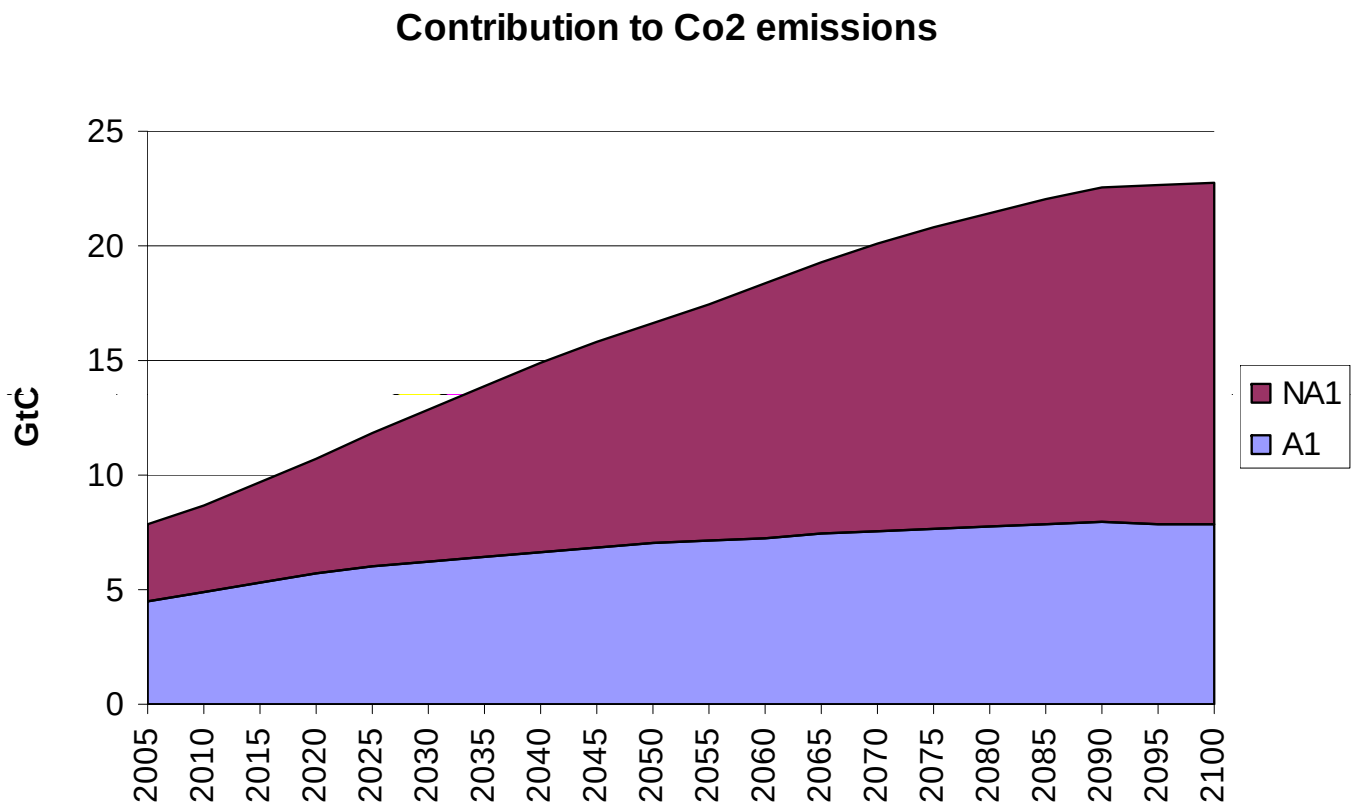
Projected regional contribution to CO2 emissions



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Which architecture for agreement?

- Global action needed: agreement on post-2012 climate policy must provide adequate incentives to participation
- Differentiated effort to increase political acceptability
  - Several proposals on the table, but need to find quantitative way/adequate metrics to compare alternative climate policy architectures
  - Harvard Project on International Climate Agreements

Policy Architectures /1

1. Global coalition with cap-and-trade and transfers
2. Global coalition with carbon tax recycled domestically
3. Global coalition with REDD
4. Climate clubs (multiple coalitions)
5. Dynamic coalitions: incremental progressive participation based on
    a. Burden sharing rules
    b. Graduation
    c. Dynamic targets
6. R&D and technology coalition

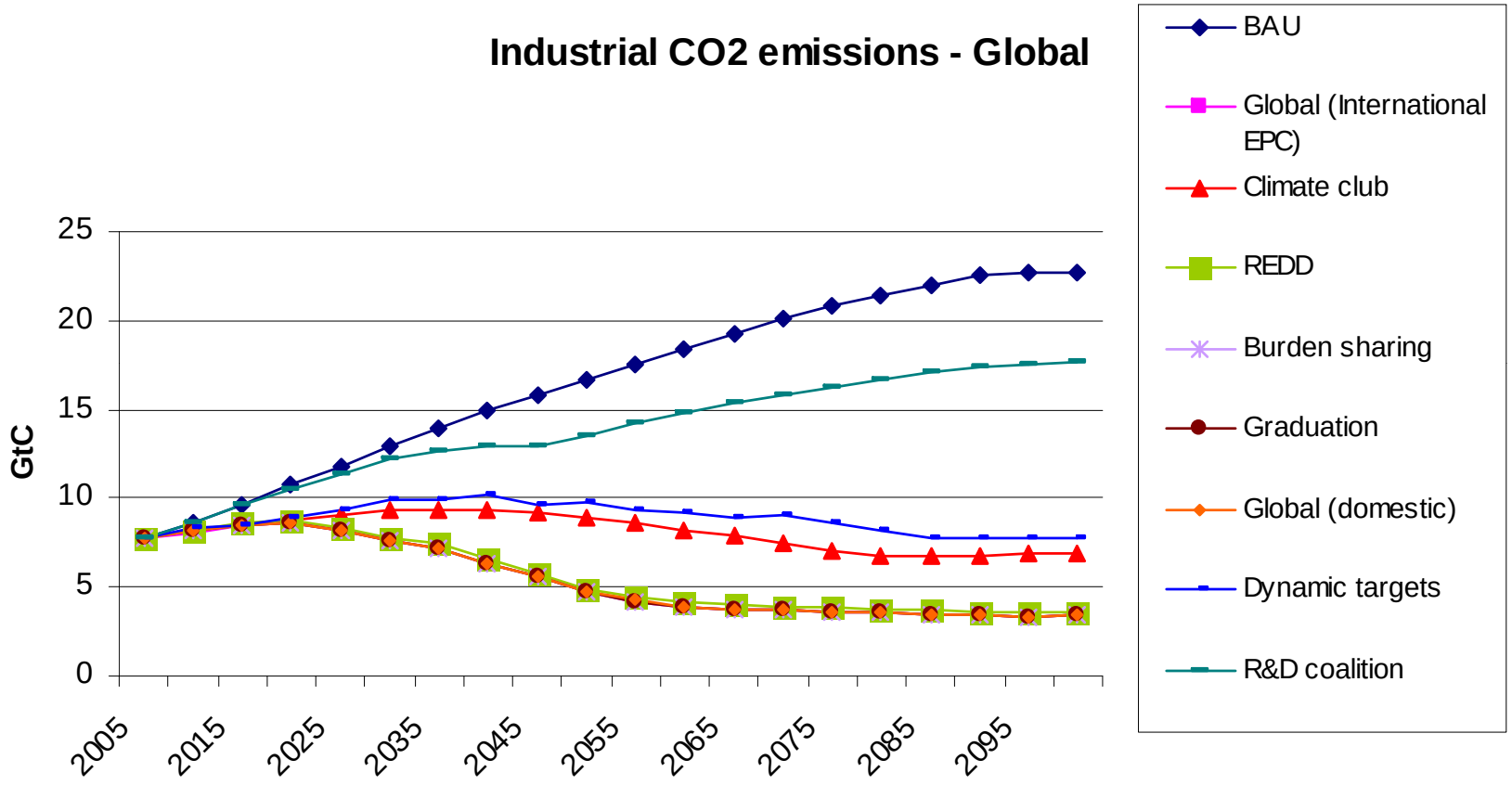
Policy Architectures /2

- Global Cap-and-Trade with Redistribution: In this benchmark scenario, all nations participate immediately in a global cap-and-trade system designed to stabilize atmospheric CO2 at 450 parts per million (ppm) by 2100. Permits are allocated to all countries on an equal per-capita basis.
- Global Tax Recycled Domestically: All countries apply a globally consistent carbon tax designed to achieve the same stabilization trajectory as above. Revenues from the tax are recycled domestically and implementation begins immediately.
- Reducing Emissions from Deforestation and Degradation: Same as the first scenario, except credits from avoided Amazon deforestation are included in the permit market.
- Climate Clubs: In this scenario, a group of mostly advanced economies agrees to abide by its Kyoto target and reduce GHG emissions 70% below 1990 levels by 2050. Other fast-growing countries and regions begin gradual efforts to reduce emissions below business-as-usual (BAU), but converge to the same level of reductions as the first group after 2050. All remaining countries face no binding targets, but their emissions are limited to BAU.

Policy Architectures /3

- Burden Sharing: Developed (Annex 1) countries commence abatement immediately, with the burden shared on an equal per capita basis. Binding emissions targets are extended to all other countries, except those in sub-Saharan Africa, in 2040.
- Graduation: Countries adopt binding emission targets as they reach specified criteria for income and emissions. Annex 1 countries compensate for the delayed entry of non-Annex 1 countries by undertaking additional reductions as required to achieve a 450 ppm stabilization trajectory.
- Dynamic Targets: Different countries adopt different targets over time depending on current and projected emissions, income, and population.
- R&D and Technology Development: No binding emissions targets; instead all countries contribute a fixed percentage of GDP to an international fund for developing low-carbon technologies

Environmental effectiveness: from emission paths…



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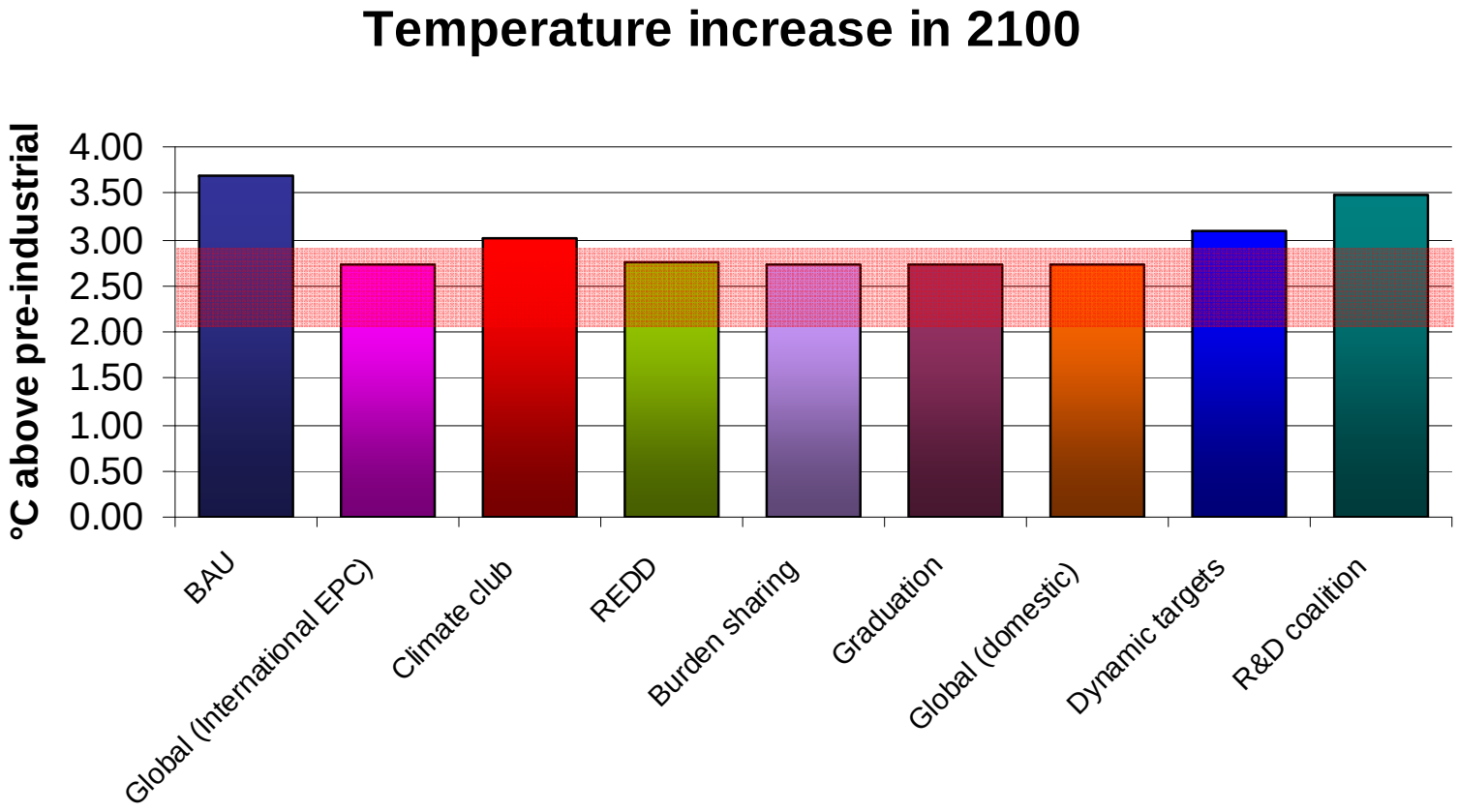
… to temperature increase



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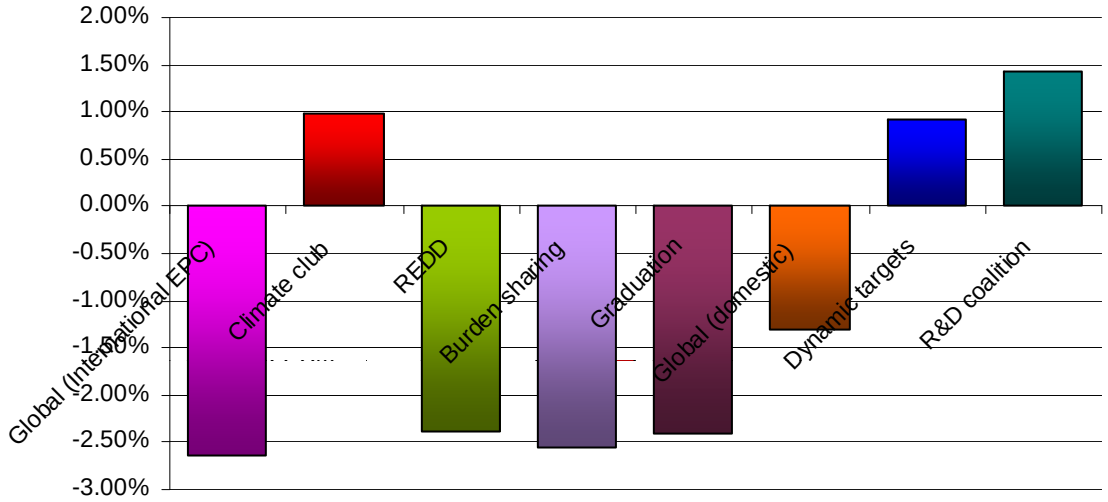
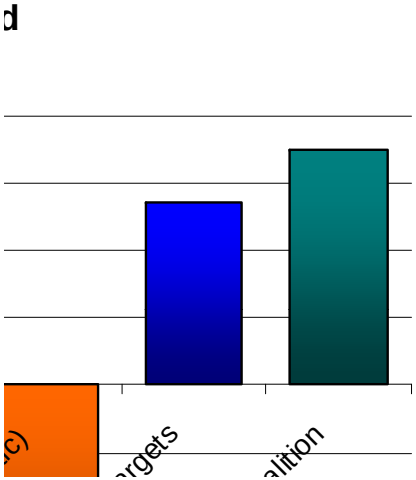
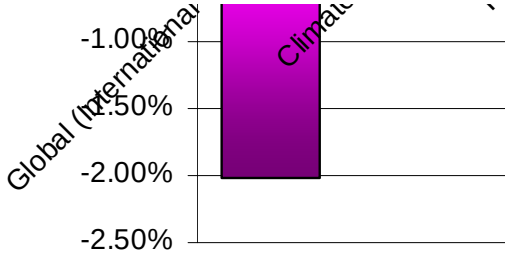
Economic efficiency

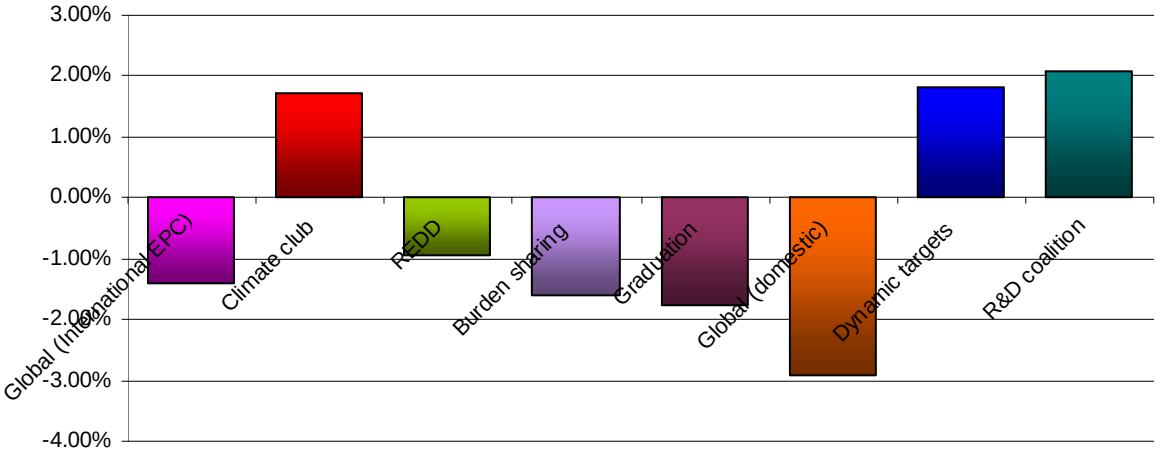
Policy costs - A1 undiscounted







Policy costs - NA1 undiscounted



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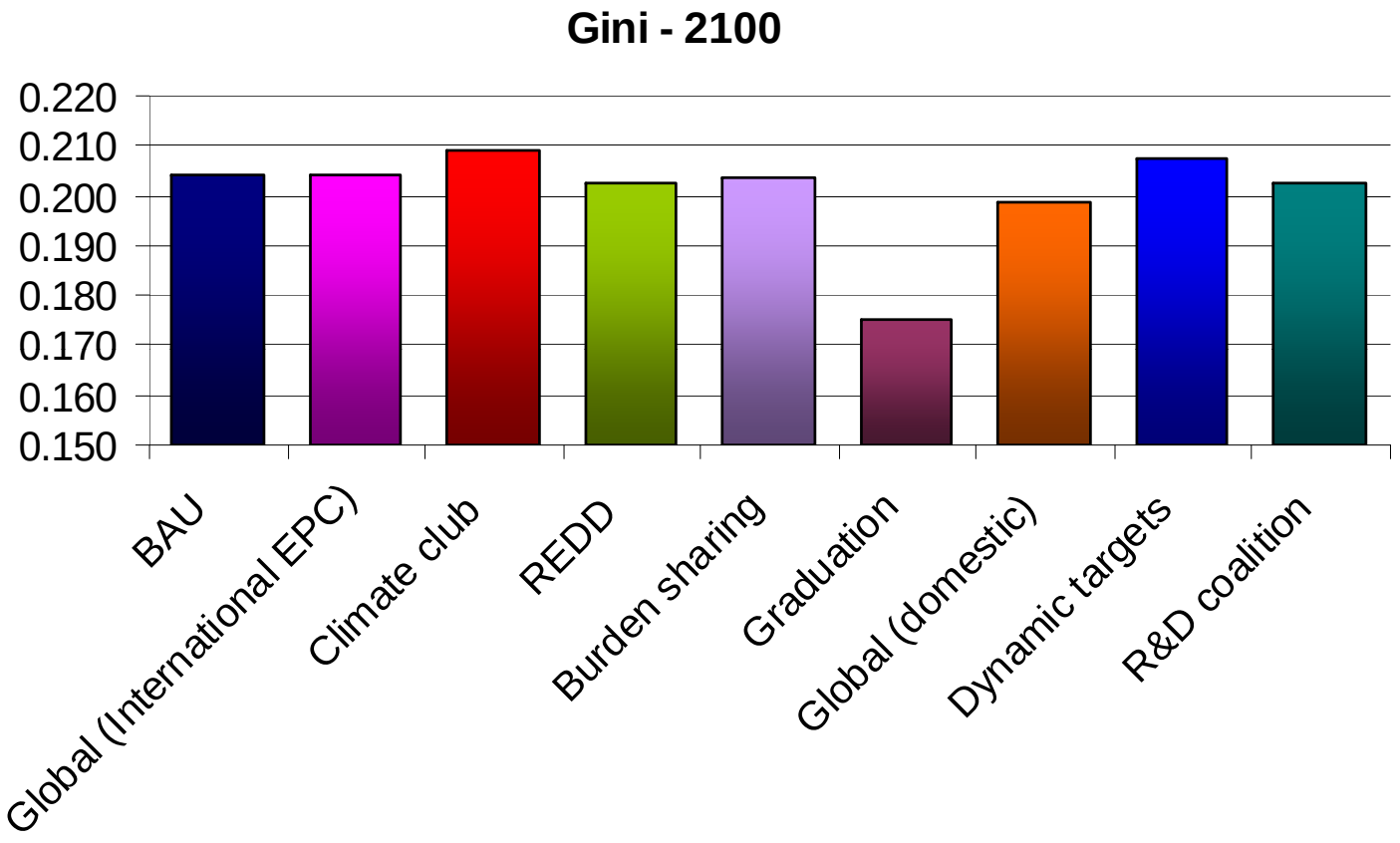
Equity and distributional impacts



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Stability and profitability

	Potential stability - World welfare	Feasibility
	% change wrt BAU	No. Of countries with +ve variation in welfare
Global (International EPC)	0.744%	4
Climate club	0.262%	11
REDD	0.721%	5
Burden sharing	0.351%	4
Graduation	0.190%	4
Global (domestic)	-0.070%	3
Dynamic targets	0.264%	11
R&D coalition	0.119%	12

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Multi Dimension Comparison

Preliminary comparison	Environmental Effectiveness (T°C above pre-industrial)	Economic Efficiency (GDP change wrt BAU, 5% d.r.)	Distributional impact (Gini 2100)	Potential stability (global welfare change wrt BAU)	Political faesibility (Countries w +ve change)
BAU	3.69		0.20		
Global (International EPC)	2.73	-2.03%	0.20	0.74%	4
Climate club	3.02	1.34%	0.21	0.26%	11
REDD	2.76	-1.68%	0.20	0.72%	5
Burden sharing	2.74	-2.08%	0.20	0.35%	4
Graduation	2.74	-2.09%	0.18	0.19%	4
Global (domestic)	2.74	-2.09%	0.20	-0.07%	3
Dynamic targets	3.09	1.36%	0.21	0.26%	11
R&D coalition	3.48	1.75%	0.20	0.12%	12

Conclusions

- None of these agreements keeps T°C below 2 degrees threshold - need to include non-CO2 GHGs mitigation to broaden option and lower costs
- Trade-off between environmental effectives, and economic efficiency and enforceability
- If stringent environmental target, need to include REDD as a mitigation option
- For milder environmental targets, burden sharing seems to perform better
- Caveats:
  - Enforceability needs to be better assessed – on going work on analysis of coalitions' stability
  - More rigorous multi criteria assessment

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Conclusions /2

- *All the policy architectures evaluated in this analysis produce warming above the 2°C target envisaged by the IPCC and the European Commission.* More drastic measures than any of those modeled for this analysis will be required to meet the target.

- *There is a clear trade-off between environmental effectiveness and cost.* The inclusion of credits for avoided deforestation helps reduce cost somewhat, but estimated gross world product (GWP) losses in all the scenarios designed to achieve CO2 stabilization at 450 ppm exceed 1%. The Climate Clubs and Dynamic Targets scenarios are significantly less costly, but also less effective. The R&D-only scenario actually leads to slight gains in GWP, but it is also the least effective in terms of reducing emissions.

Conclusions /3

- *There is a clear trade-off between environmental effectiveness and enforceability*. If one assumes that countries' willingness to participate will depend on the expected welfare effects of the policy, then the more stringent architectures - because they are more costly - will also be the most difficult to enforce.

- *Any of these architectures would produce a more fair distribution of income in 2100 relative to the current situation.* In the more stringent scenarios (i.e., those designed to stabilize CO2 at 450 ppm), however, these gains in equality occur in the context of significant overall GDP losses. Of the architectures modeled, the most egalitarian are Climate Clubs, Graduation, and Dynamic Targets because they distribute the abatement burden according to per capita income and emissions. The inclusion of credits for avoided deforestation (3) also improves equity because most forest-related abatement opportunities are located in developing countries.

Thank you!

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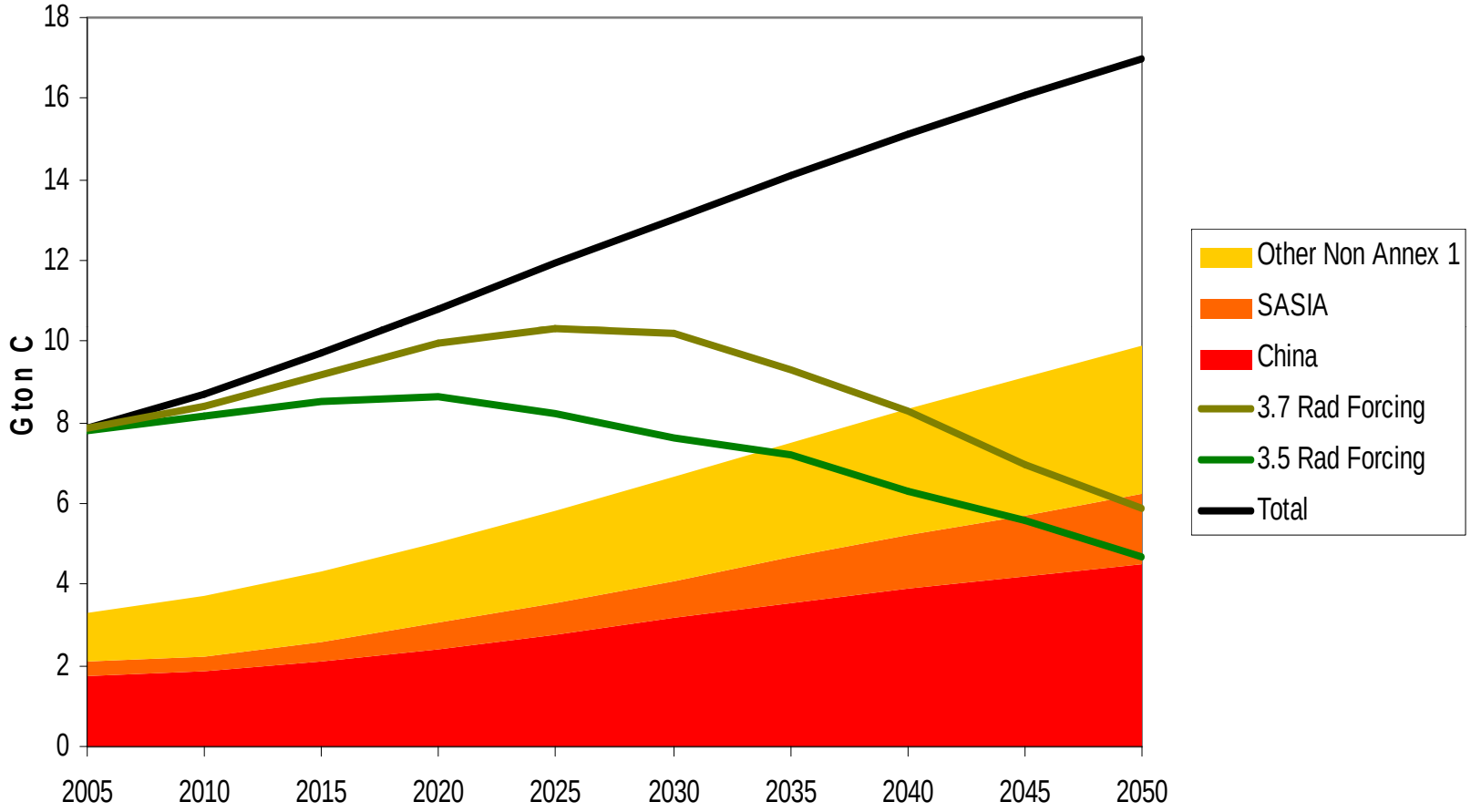
Time is short….



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