Fondazione Eni Enrico Mattei

Global climate change policy

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Overview

An important issue for European climate change policy is to understand what are the relative merits of alternative global policy outcomes (Copenhagen 2009)

1. Valentina Bosetti and Barbara Buchner simulate a set of 12 **simplified global policy scenarios**.

2. Valentina Bosetti, Carlo Carraro, Alessandra Sgobbi and Massimo Tavoni explore **8 policy architectures** inspired by the proposals put forward within the Harvard Project on International Climate Agreements.

In both cases the quantitative comparison is made using WITCH, a hybrid optimal growth economic-climate model.

In both analysis, the authors compute for each scenario a set of indicators that capture the main features of the policy scenario: cumulated discounted GDP over a century (economic costs), temperature increase (environmental effectiveness), Gini equity indicator by 2100, enforceability, and others.

Key Messages/1

1. If an **agreement** involving global commitment 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. **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, but moving to more ambitious targets compatible with climate stabilization requires progressively increasing economic resource commitments.
3. 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.
4. Climate policies are shown to have the potential to yield potential benefits in terms of distribution of income across regions. The magnitude of **equity** improvements depends on the **compensation mechanisms** assumed in the policies.

Key Messages/2

5. Among the **simplified 12 agreements** analysed in the first study, when accounting not only for policy costs (GDP losses), but also for environmental effectiveness and equity, the “optimal” agreement requires stabilisation of GHG concentrations at 450 CO2 only, using an equal per capita emissions allocation rule.
6. Among the **politically based 8 agreements**, analysed in the second study:
   - 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.
   - 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 are shown to have a very limited climate effectiveness, thus suggesting that R&D provisions are necessary but not sufficient elements of an effective climate policy.

Simplified 12 global policy scenarios

Table 1: An overview on the alternative policy architectures			
Expected Emissions			
	2010	**2020**	**from 2020 onwards**
Scenario 1 "BAU - Business-as-Usual"			
Annex B_{-US}	"Business-as-Usual"		
US			
Developing countries			
Scenario 2 "Kyoto Forever without US"			
Annex B_{-US}	Kyoto target: -5.2% wrt 1990	2010 level	
US	-18% intensity target	business-as-usual	
Developing countries	business-as-usual		
Scenario 3 "Kyoto Forever without US only in the first commitment period"			
Annex B_{-US}	Kyoto target: -5.2% wrt 1990	2010 level	
US	-18% intensity target	Kyoto constraint	2020 level
Developing countries	business-as-usual		
Scenario 4 "Annex B cooperation only until 2020"			
Annex B_{-US}	Kyoto target: -5.2% wrt 1990	-20% wrt 1990	"Business-as-Usual"
US	-18% intensity target		
Developing countries	business-as-usual		
Scenario 5 "Enhanced permanent global cooperation"			
Annex B_{-US}	Kyoto target: -5.2% wrt 1990	-20% wrt 1990	"Enhanced cooperation"[1]
US	-18% intensity target		
Developing countries	business-as-usual		
Scenario 6 "Stabilisation at 550 ppmv through sovereignty allocation"			
Annex B_{-US}	Kyoto target: -5.2% wrt 1990	-30% wrt 1990	Stabilisation at 550 ppmv in 2100; emission entitlements in proportion to emissions in base year
US	-18% intensity target		
Developing countries	business-as-usual		

Simplified 12 global policy scenarios

Scenario 7 "Stabilisation at 550 ppmv through equal-per-capita allocation"			
Annex B_{-US}	Kyoto target: -5.2% wrt 1990	-30% wrt 1990	Stabilisation at 550 ppmv in 2100; equal-per-capita emission entitlements
US	-18% intensity target		
Developing countries	business-as-usual		
Scenario 8 "Stabilisation at 550 ppmv through Contraction & Convergence"			
Annex B_{-US}	Kyoto target: -5.2% wrt 1990	-30% wrt 1990	Stabilisation at 550 ppmv in 2100 with emission reductions allocated according to C&C: emission entitlements in proportion to emissions in base year converge towards equal per capita levels over time
US	-18% intensity target		
Developing countries	business-as-usual		
Scenario 9 "Stabilisation at 450 ppmv through sovereignty allocation"			
Annex B_{-US}	Kyoto target: -5.2% wrt 1990	-30% wrt 1990	Stabilisation at 450 ppmv in 2100; emission entitlements in proportion to emissions in base year
US	-18% intensity target		
Developing countries	business-as-usual		
Scenario 10 "Stabilisation at 450 ppmv through equal-per-capita allocation"			
Annex B_{-US}	Kyoto target: -5.2% wrt 1990	-30% wrt 1990	Stabilisation at 450 ppmv in 2100; equal-per-capita emission entitlements
US	-18% intensity target		
Developing countries	business-as-usual		
Scenario 11 "Stabilisation at 450 ppmv through Contraction & Convergence"			
Annex B_{-US}	Kyoto target: -5.2% wrt 1990	-30% wrt 1990	Stabilisation at 450 ppmv in 2100 with emission reductions allocated according to C&C: emission entitlements in proportion to emissions in base year converge towards equal per capita levels over time
US	-18% intensity target		
Developing countries	business-as-usual		
Scenario 12 "Meaningful Action"			
Annex B_{-US}	Kyoto target: -5.2% wrt 1990	-30% emission target 2020 wrt 1990	-70% emission target 2050 wrt 1990, then stabilise there
US	-18% intensity target		
Developing countries	business-as-usual until 2030 (for China and India), business-as-usual until 2050 (for Rest of the World)		-5% emission target 2050 wrt 2005

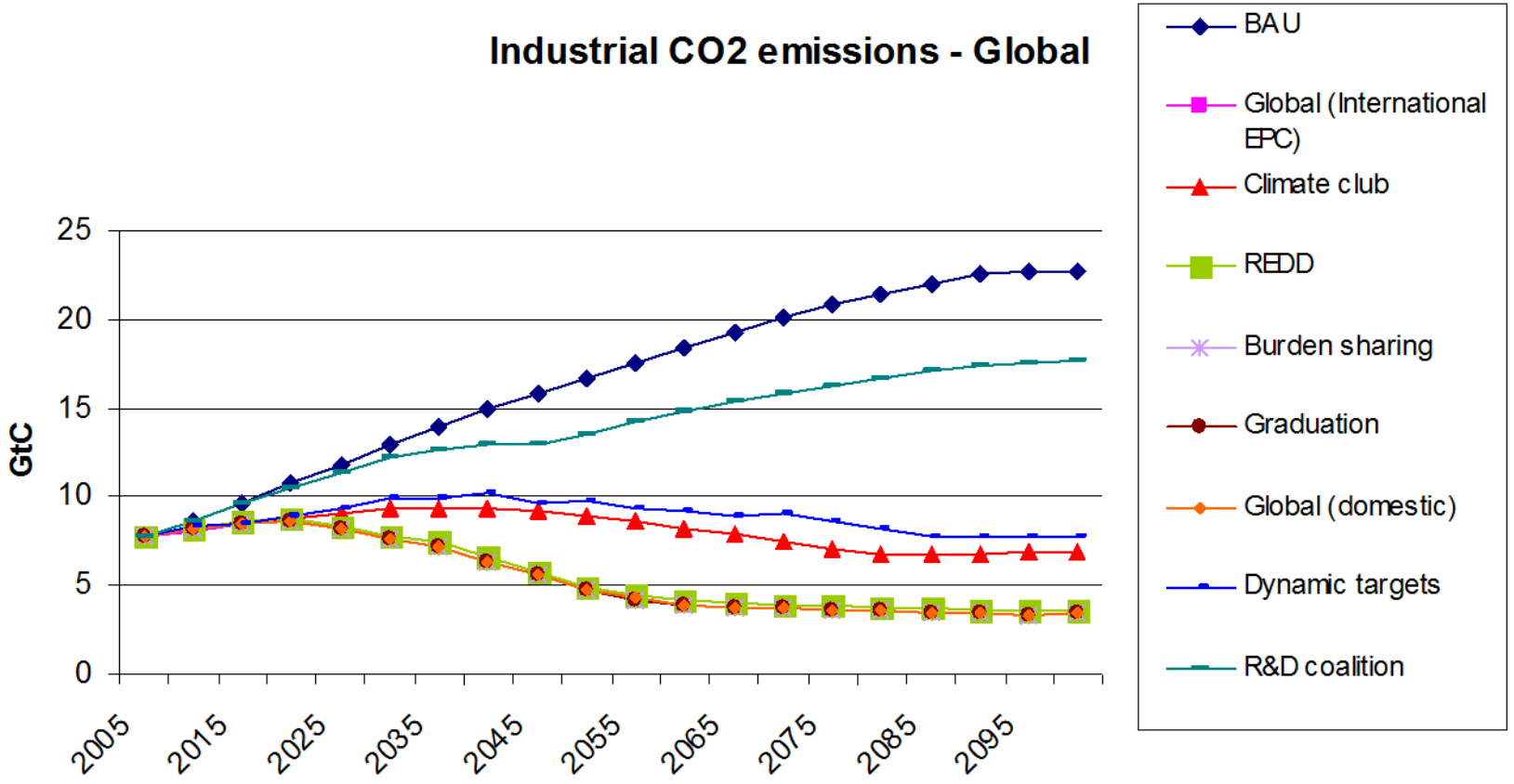
Policy Architectures

1. Global coalition with CAT and transfers
2. Global coalition with carbon tax recycled domestically
3. Global coalition with REDD
4. Climate Clubs (sub-coalitions)
5. Dynamic coalitions: incremental participation based on
    a. Burden sharing rules
    b. Graduation
    c. Dynamic targets
6. R&D and Technology coalition

Policy Architectures: distinguishing features

	Scope	Timing	Key feature
Global (International EPC)	Universal	Immediate	Cap and trade with redistribution (EPC)
Climate club	Partial	Incremental	Joint agreement for club – cap and trade and R&D cooperation
REDD	Universal	Immediate	Cap and trade with inclusion of REDD
Burden sharing	Universal	Incremental	Delayed partecipation. Cap and trade immediate
Graduation	Partial	Incremental	Bottom up targets
Global (domestic)	Universal	Immediate	Global carbon tax recycled domestically
Dynamic targets	Universal	Incremental	Bottom up targets
R&D coalition	Universal	Immediate	No climate target. R&D cooperation

Environmental effectiveness: from emission paths…



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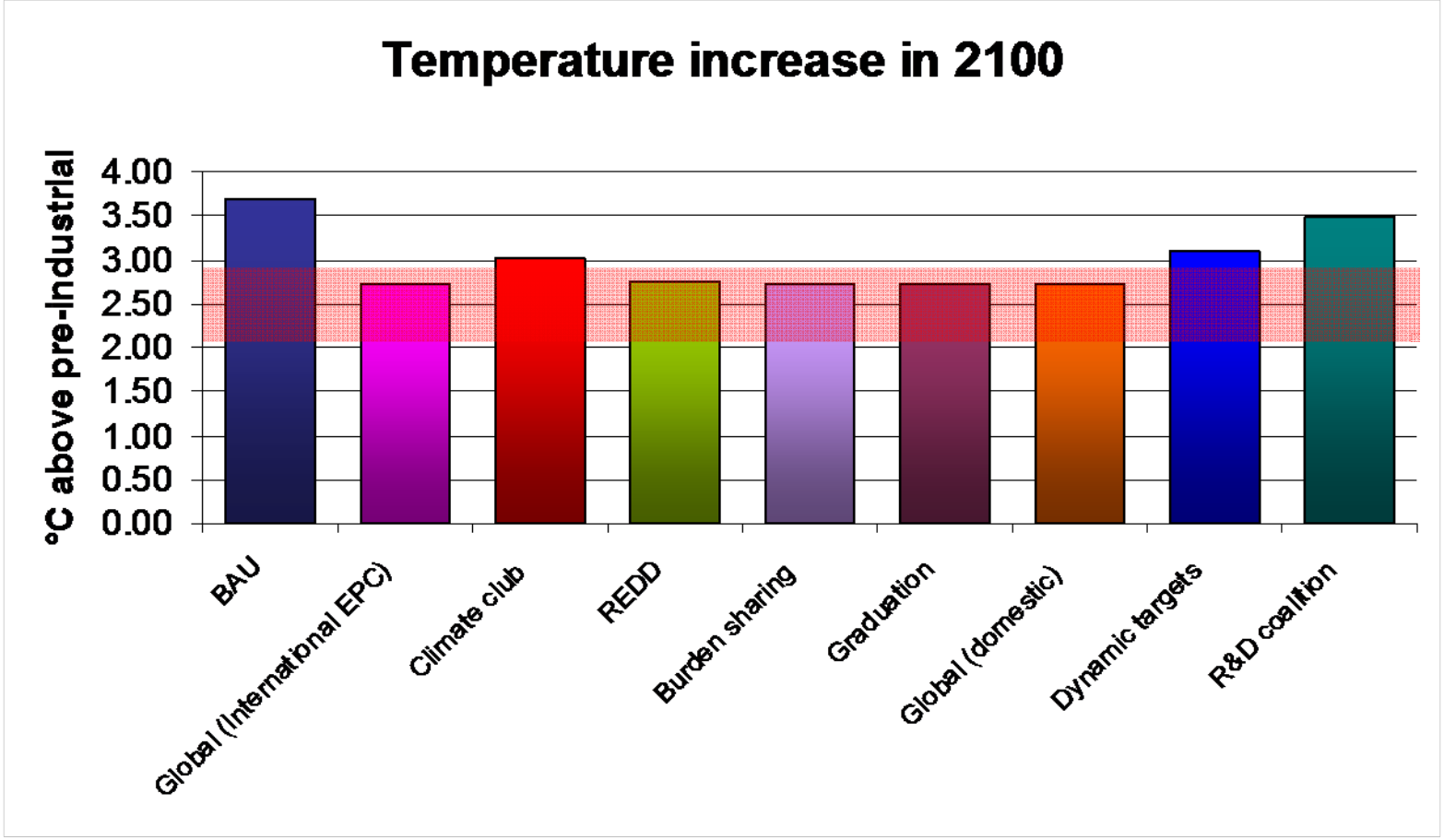
… to temperature increase



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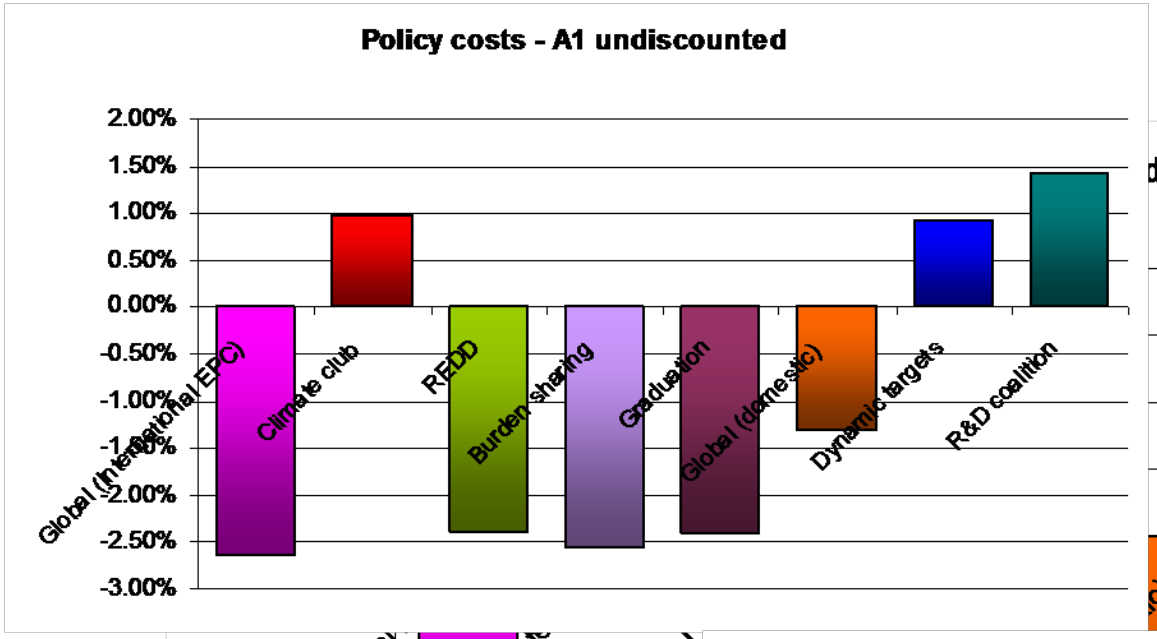
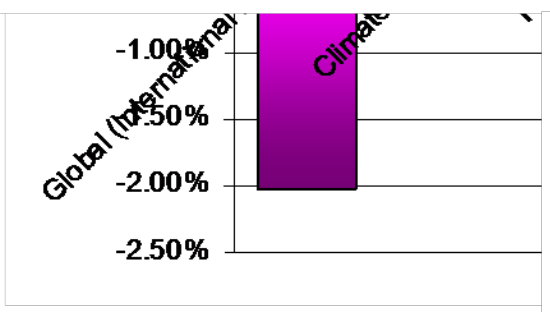
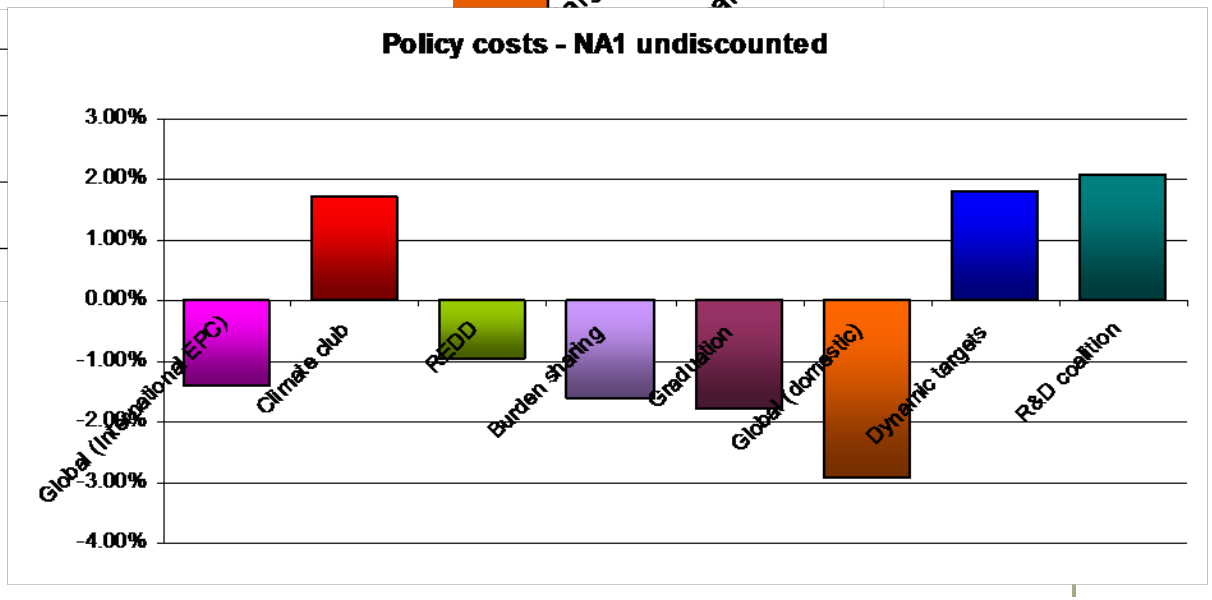
Economic efficiency







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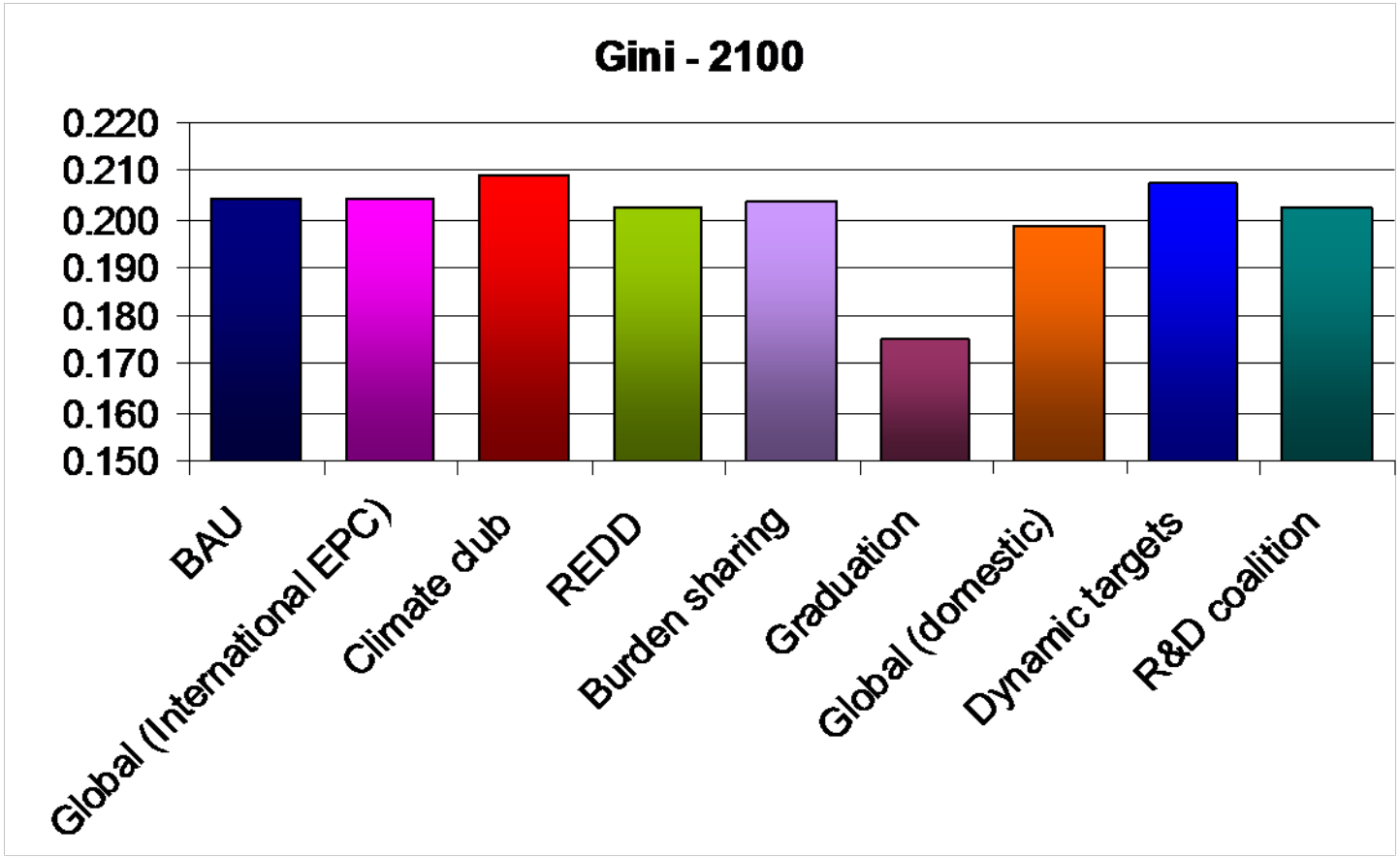
Equity and distributional impacts



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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**

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 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

Thank you

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