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"Montreal Strategic Climate Change Workshop on Sub-National Strategies for Clean Energy Investment, Technology Deployment and Innovation"
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Regional and Sub-Global Climate Blocs.

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Background

Climate Change control = global governance problem

But: broad participation on climate change control is hard to achieve because of:

- **Public good – free-riding incentives**
  - ⇨ ”Quasi” Tragedy of the Commons
  - ⇨ Intrinsic instability of environmental negotiations.
- Large economic and environmental **structural asymmetries** among world regions
- Absence of **supra-national authority**

⇨***low environmental effectiveness*** of the Kyoto Protocol

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Therefore….

- **The current climate regime is unlikely to be the final one**

- **Recent discussions on post 2012 already suggest a more complex regime than Kyoto**

  - ⇨ **Including technology policy**
  - ⇨ **Adaptation policy**
  - ⇨ **Special concerns for developing countries**

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However…

In practice a lot of action ongoing…

- Measures are taken at the city, state, country and regional levels
- All these measures resemble the dynamics of trade agreements in the past and even recently with the resurgence of regionalism
- 250 RTA notified to the WTO by December 2002. More than 300 expected by the end 2005.
- Can climate policy follow the same route? I.e. are we going to observe the formation of climate blocs?

Our approach

Positive approach

- What are incentives for negotiating countries?

Theoretic background

- Game-theoretic studies show that equilibrium of a coalition formation games is characterised by several small blocs (agreements); political science studies

Similarities with trade agreements

- Progress on trade liberalisation mostly through regional agreements
- RTAs may actually often support the WTO's multilateral trading system (Sampson and Woolcock)

Main question:

Can regional agreements/sub-global bloc structures lead to better economic and environmental outcomes than the current climate coalition?

Lessons from coalition theory

Non-cooperative game theory:

- If countries are free to decide not only whether to join a coalition but also which coalition:
  generally **more than one coalition** at the equilibrium
- Usually: co-operators - free-riders
- At equilibrium, group of co-operators split into several subgroups: several coalitions form

⇨ **application to climate negotiations**:
fragmented climate regime:
some groups of countries cooperate, others free-ride

Limitations of game theory

Assumption of asymmetry:
characteristics of the coalitions which form at the equilibrium cannot be identified

⇨ **Need for an applied economic analysis**:
enables identification of the incentives which lead countries to a fragmented regime

Methodology and main assumptions

- **Focus on Post Kyoto**: 2010-2100
- Priority to **economic incentives**
- **Quantitative assessment** through a simple **integrated model: FEEM-RICE** with endogenous/induced technical change
- **Game-theoretic framework**: six players (EU, JPN, FSU, US, CHN, ROW); 4 strategic variables; dynamic open-loop Nash game; extension of PANE - equilibrium concept (Chander and Tulkens, 1995/97); open membership rule
- Adoption of **cost-effective environmental policies**

Steps

- **Starting point**:
  the existing climate regime

- **Background:**
  news from climate diplomacy

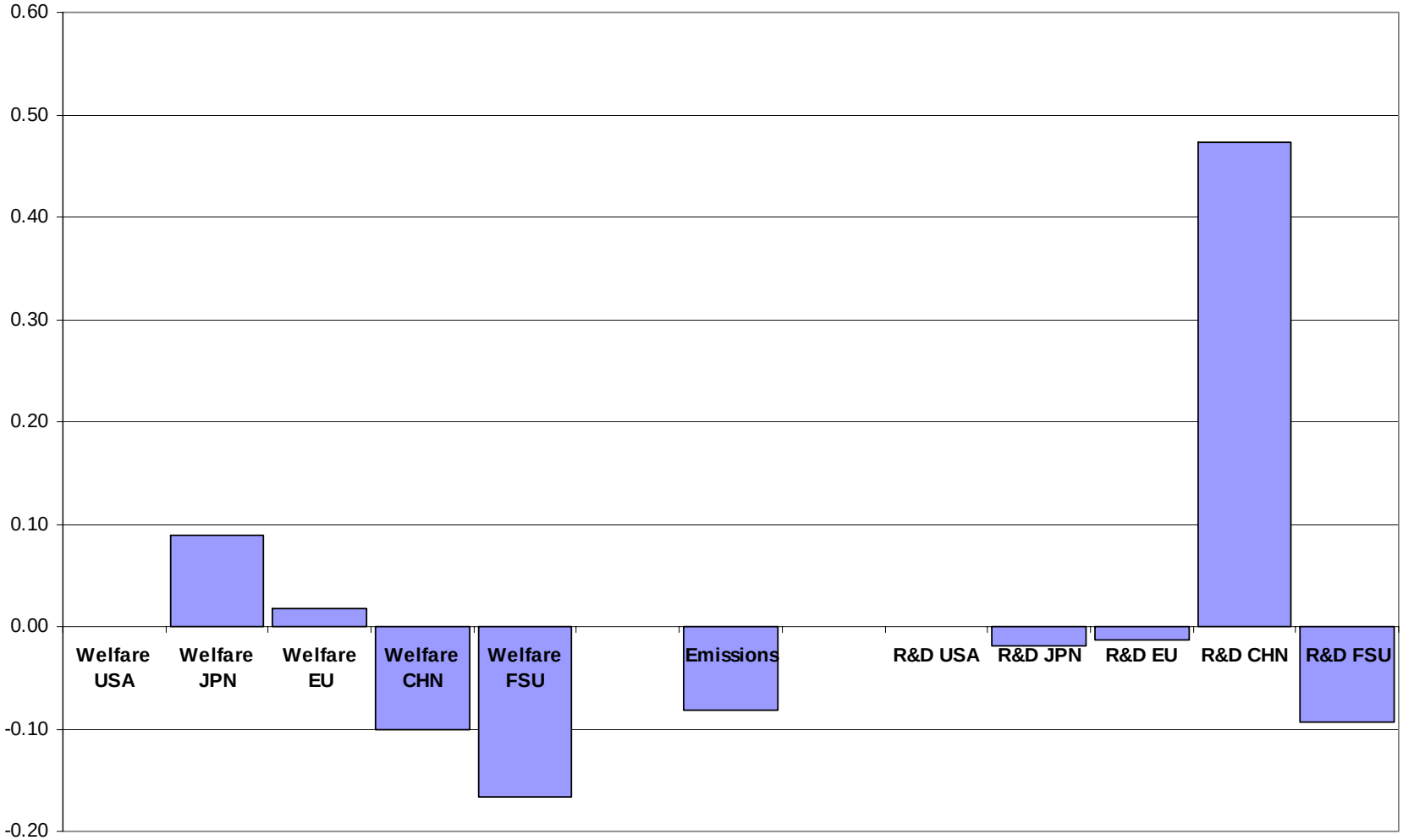
- **Strategy:**
  analysis of ***economic incentives*** to move away from present situation by comparing the current regime to other potential regimes

Post 2012 - Scenario 1

A fragmented regime of 2 climate blocs:

- **Bilateral deal between EU and Russia:**
  recent evidence (TACIS; Kyoto)
  beneficial both for EU (high abatement costs) and Russia (relations)
- **Bilateral deal between Japan and China:**
  evidence for regional focus in Asia
  beneficial both for Japan (high abatement costs) and China (profits, environment); weight to region

Scenario 1: (EU+Russia), (Japan+China)



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Post 2012 - Scenario 1: Results

- **Decline in permit price**
- **Japan**: gains thanks to lower abatement costs
- **EU**: small welfare gain due to lower abatement costs
- **China:** decrease in welfare; increase in strategic R&D investments
- **Russia**: main loser due to smaller price, smaller market, decrease in strategic R&D investments
- **Environmental effectiveness**: total emissions decrease because of higher abatement in China

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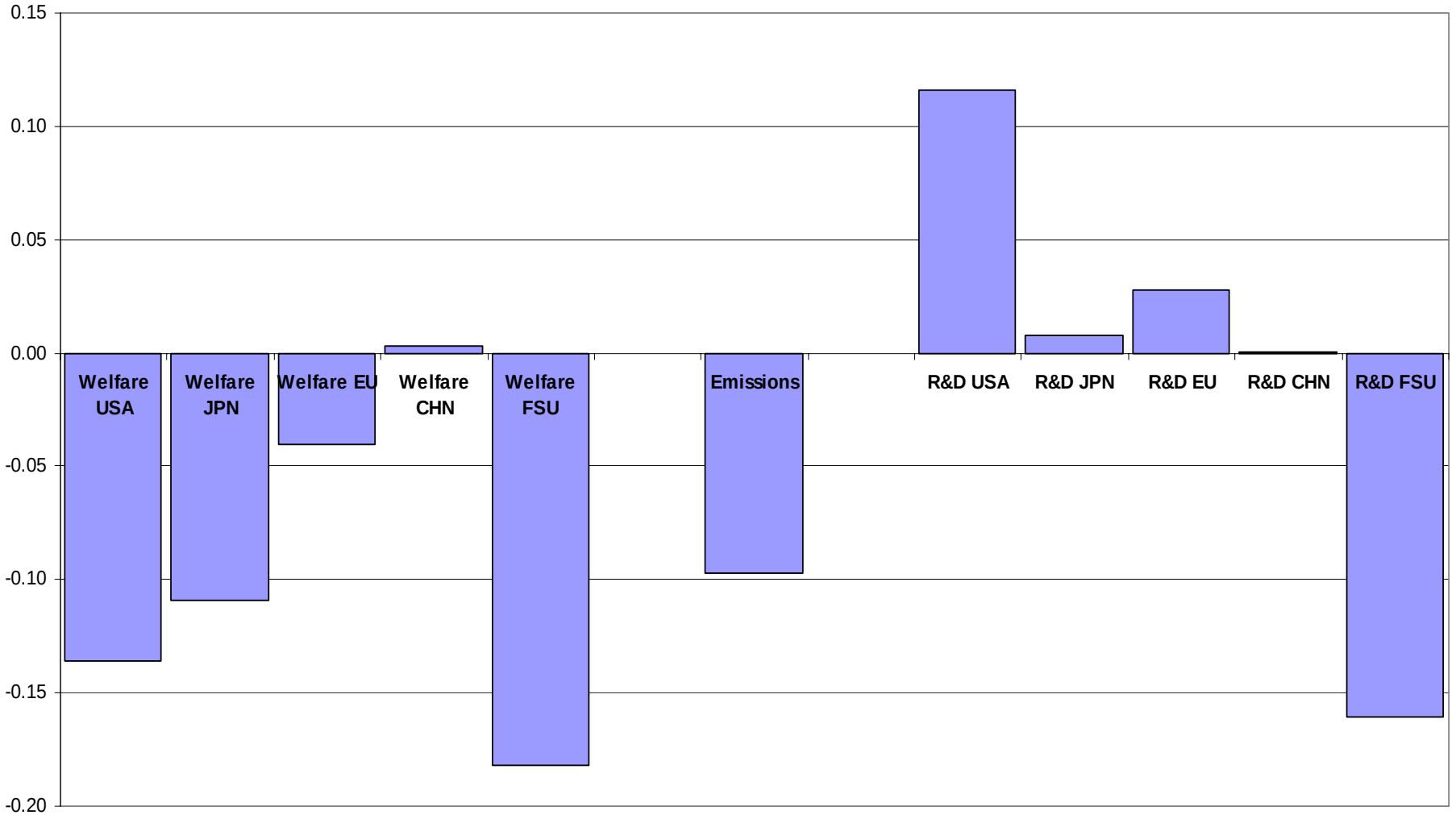
Post 2012 - Scenario 2

A fragmented regime of 2 climate blocs:

- **Bilateral deal between US and Russia:**
  US search for alternatives;
  beneficial both for US (high abatement costs) and Russia (incentives; relations)

- **Bilateral deal between EU and Japan:**
  Kyoto commitment

Scenario 2: (US+Russia), (EU+Japan)



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Post 2012 - Scenario 2: Results

- **China:** increases welfare because of increase in global abatement
- **Japan, EU**: lose because of strong increase in abatement costs
- **US:** decrease in welfare due to abatement obligations; increase in R&D investment
- **Russia**: decrease in welfare due to lower permit price, decrease in strategic R&D investments
- **Environmental effectiveness**: total emissions decrease because of higher global abatement

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Post 2012 - Scenario 3

A fragmented regime of 2 climate blocs:

- Bilateral deal between US and China
- Cooperation between EU, Japan and Russia

Motivations:

- US is unlikely to break Annex B_{-US} bloc
- Involvement of developing countries is considered as crucial, in particular for US

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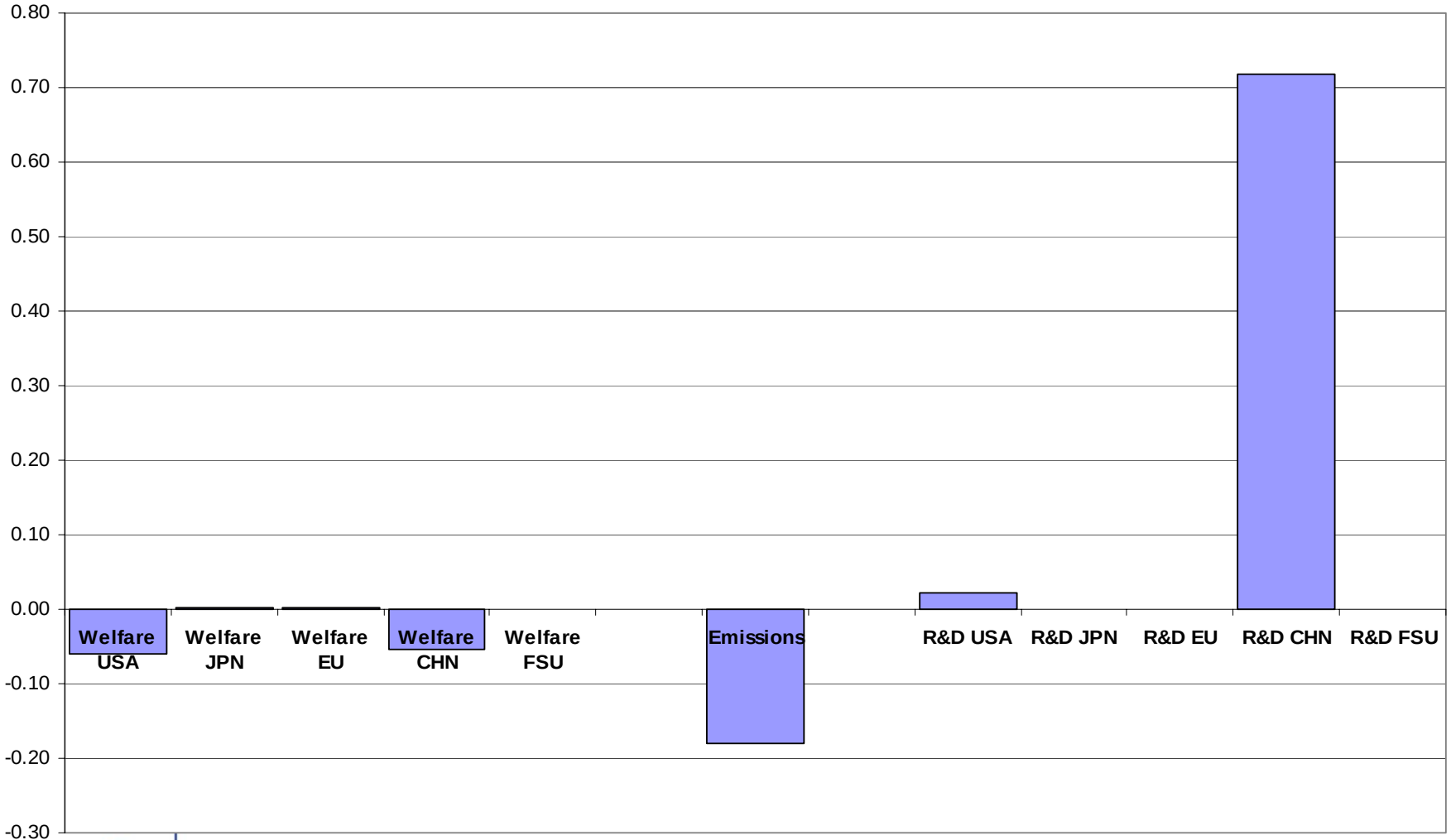
Scenario 3: (US+China), (EU+Japan+Russia)



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Post 2012 - Scenario 3: Results

- **China, US:** lose wrt free-riding; but: very small losses, could be compensated by ancillary benefits
- **China:** large expansion of R&D investments
- **Japan, EU, Russia**: slightly beneficial due to higher environmental effectiveness
- **Environmental effectiveness**: strong decrease in total emissions (-20%) because of higher global abatement

Synthesis

- **Post 2012 – Scenario 1:** profitable to Japan and EU who could therefore implement some compensation scheme for China and Russia; but: unlikely to emerge because US not involved

- **Post 2012 – Scenario 2:** unlikely to emerge because lack of incentives (total welfare of all countries decreases)

- **Post 2012 – Scenario 3:** small welfare losses for US and China, small welfare gains for Annex B_{-US}, enhanced environmental effectiveness;
more likely to emerge although…

From the analysis of all coalition structures:

- Consistently with game theoretic analyses, we assessed cost and benefits for all world regions in all feasible coalition structures

- Outcomes compared in terms of both economic efficiency and environmental effectiveness

Economic efficiency: cross-comparisons

CHN	USA
(JPN, EU) & (USA, FSU)	(JPN, EU, FSU)
(USA, JPN, EU, FSU)	(JPN, CHN) & (EU, FSU)
(JPN, EU, FSU)	(JPN, EU)
(JPN, EU)	(EU, FSU)
(EU, FSU)	(JPN, EU, CHN, FSU)
(JPN, EU, FSU) & (USA, CHN)	(JPN, EU, FSU) & (USA, CHN)
(USA, JPN, EU, CHN, FSU)	(USA, JPN, EU, CHN, FSU)
(JPN, EU, CHN, FSU)	(JPN, EU) & (USA, FSU)
(JPN, CHN) & (EU, FSU)	(USA, JPN, EU, FSU)

Economic efficiency: cross-comparisons

JPN	EU	FSU
(EU, FSU)	(JPN, EU, CHN, FSU)	(JPN, EU)
(JPN, CHN) & (EU, FSU)	(USA, JPN, EU, CHN, FSU)	(USA, JPN, EU, FSU)
(JPN, EU, CHN, FSU)	(JPN,CHN) & (EU, FSU)	(JPN, EU, FSU)
(USA, JPN, EU, CHN, FSU)	(EU, FSU)	(JPN, EU, FSU) & (USA, CHN)
(JPN, EU, FSU) & (USA, CHN)	(JPN, EU, FSU) & (USA, CHN)	(JPN, EU, CHN, FSU)
(JPN, EU, FSU)	(JPN, EU, FSU)	(EU, FSU)
(USA, JPN, EU, FSU)	(USA, JPN, EU, FSU)	(JPN, CHN) & (EU, FSU)
(JPN, EU) & (USA, FSU)	(JPN, EU) & (USA, FSU)	(JPN, EU) & (USA, FSU)
(JPN, EU)	(JPN, EU)	(USA, JPN, EU, CHN, FSU)

Summary and Policy Conclusions

Incentives in international climate policy:

- **China, US:** strong incentive to free-riding. If they decide to participate: bilateral bloc
- **Russia:** strong incentive to keep large developing countries out of the coalition
- **Japan, EU:** strong incentive to maintain cooperation with Russia; US involvement not beneficial in short term
- ***current climate regime*:**
  fairly stable in terms of economic incentives, highly ineffective from environmental viewpoint

Environmental Effectiveness and Global Welfare

Ranking according to global welfare and global emissions

Global Welfare	Global GHG Emissions
(JPN, EU, CHN, FSU)	(USA, JPN, EU, CHN, FSU)
(JPN, CHN) & (EU, FSU)	(JPN, EU, FSU) & (USA, CHN)
(EU, FSU)	(JPN, EU) & (USA, FSU)
(JPN, EU, FSU)	(USA, JPN, EU, FSU)
(USA, JPN, EU, CHN, FSU)	(JPN, CHN) & (EU, FSU)
(JPN, EU, FSU) & (USA, CHN)	(JPN, EU, FSU)
(JPN, EU)	(JPN, EU, CHN, FSU)
(USA, JPN, EU, FSU)	(EU, FSU)
(JPN, EU) & (USA, FSU)	(JPN, EU)

Summary and Policy Conclusions

- **In the *short term*, a move from the current climate regime is not likely.**

- **It is unlikely that the US and large developing countries keep rejecting any form of climate cooperation.**

- **There seems to be high incentives for the emergence of a two-bloc climate regime:**

  (US+China) - Annex B_{-US}

  - highest benefits for environment
  - moderate economic costs for cooperating countries

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Insights for this workshop

- ⇨ **Strong incentives for the emergence of fragmented, parallel sub-global strategies; "coalitions of the like-minded"**
- ⇨ **R&D is crucial variable in climate negotiations.**
- ⇨ **These sub-global, bottom-up strategies can be a first step towards global climate change control.**

Thank you for your attention!

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