**Research Question**
How do international macro-economic effects affect the possibility of a stable global climate agreement?

**Motivation**
Game-theoretic modeling using the core stability concept predicts the existence of a stable global climate agreement, in contrast to reality.

In the classical model, consumption loss from GHG emission reduction measures only depends on each region’s own emissions:

\[ C_i = C_i(E_i) \]

This assumption is unrealistic. Emission reduction measures in one region cause, inter alia:

- technological spill-overs,
- changes in international competitiveness,
- changes in fossil fuel prices.

We change the model to include these effects:

\[ C_i = C_i(E), \quad E = (E_1, \ldots, E_n) \]

The revised model includes consumption functions for all possible **coalitions** of regions.

**Methodology**

The global CGE model DART computes consumption changes for each coalition, while damages are taken from the RICE model.

DART is a global computable general equilibrium (CGE) model consisting of eight world regions. It was used to compute **consumption change** for all 255 possible coalitions.

**Results**

**Benchmark cases**
In the low damages scenario, global emissions in the case of no cooperation (“All Singletons”) peak only around 2100 and lead to global warming of 5.1°C. Global cooperation substantially reduces emissions and produces a temperature increase of 3.9°C. In the high damages scenario, global cooperation leads to an emissions peak in 2029 and global warming of 2.0°C.

**Low Damages scenario**
The best partition of the game is better than the case of global cooperation. The core of the game is empty, a stable global agreement is not possible, contrary to the classical model.

**Why is stable global cooperation not possible?**

Cooperation is blocked by **fossil fuel exporting regions**, specifically Australia / New Zealand, Former Soviet Union, Middle East and North Africa. If emission reduction measures were enacted globally, fossil fuel prices and consumption would fall, leading to revenue losses for these regions. Other regions can form a coalition of the willing, leading to only slightly higher damages than global cooperation. Therefore, other regions have no incentive to compensate fossil fuel exporters.

**High Damages scenario**

Global cooperation is the best partition of the game and a core-stable global agreement exists.

**Why is stable global cooperation possible?**

High damages imply high gains from global cooperation. The blocking regions from the low damages scenario, especially Middle East and North Africa, experience relatively high damages from climate change. Therefore, the benefits from global cooperation exceed the revenue losses from fossil fuel exports.

**Summary**

- International macro-economic effects create new hurdles for a stable global climate agreement
- Fossil fuel exporters block cooperation, because it would reduce fossil fuel prices and consumption
- High damages from climate change create an incentive for cooperation
- Partial cooperation, excluding blocking regions, can almost reach optimal emission reduction levels

**Contact**

Jan Kersting  
Fraunhofer Institute for Systems and Innovation Research ISI | Breslauer Straße 48 | D-76139 Karlsruhe  
Phone: +49 (0)721-6809-474 | E-mail: jan.kersting@isi.fraunhofer.de | http://www.isi.fhg.de

- **Further Information**
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