

# The Economics of Climate Change and International Agreements

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# Overview

- What *should* we do about climate change?
  - This perspective assumes that the world can work together to address climate change.
  - **Idealist.**
- What *can* we do about climate change?
  - This perspective recognizes that power is vested in nation states, and that treaties must try to overcome collective action failures.
  - **Realist.**

What should we do?

# Framework Convention

- *“The ultimate objective of this Convention...is to achieve...stabilization of greenhouse gas concentrations in the atmosphere at a level that would prevent **dangerous anthropogenic interference** with the climate system [emphasis added].”*
- But what level is dangerous?

# European Union

- EU declares in 1996 that *“global average temperatures should not exceed 2°C above pre-industrial level.”*
- According to the EC, *“once global warming exceeds 2°C, climate impacts on food production, water supply and ecosystems are projected to increase significantly and irreversible catastrophic events may occur.”*

# Copenhagen Accord

*“To achieve the ultimate objective of the Convention to stabilize greenhouse gas concentration in the atmosphere at a level that would prevent dangerous anthropogenic interference with the climate system, we shall, recognizing the scientific view that the increase in global temperature should be below 2 degrees Celsius, on the basis of equity and in the context of sustainable development, enhance our long-term cooperative action to combat climate change.”*

(Note: Does not specify a base year.)

# Cancun Agreement (UNFCCC)

*“...deep cuts in global greenhouse gas emissions are required..., with a view to reducing global greenhouse gas emissions so as to hold the increase in global average temperature below 2°C above pre-industrial levels....”*

*“Also... need to consider... strengthening the long-term global goal on the basis of the best available scientific knowledge, including in relation to a global average temperature rise of 1.5°C...”*

# Where are we now?

- According to AR4, *“the total temperature increase from 1850-1899 to 2001-2005 is  $0.76^{\circ}\text{C} \pm 0.19^{\circ}\text{C}$ .”*
- And if greenhouse gases were stabilized [at the 2000 level] *“a further warming of  $0.5^{\circ}\text{C}$  would occur.”*
- *“This should not be confused with ‘unavoidable climate change’ over the next half century, which would be greater because forcing cannot be instantly stabilised.”*

# Climate Sensitivity

According to EU, 450 may be exceeded in 2010-2015.

Eq. CO <sub>2</sub> - eq ppm	Temperature increase °C		
	Best estimate	Very likely above	Likely in the range
350	1.0	0.5	0.6-1.4
450	2.1	1.0	1.4-3.1
550	2.9	1.5	1.9-4.4
650	3.6	1.8	2.4-5.5
750	4.3	2.1	2.8-6.4
1,000	5.5	2.8	3.7-8.3
1,200	6.3	3.1	4.2-9.4

AR4 Technical Summary, Talbe TS-5.

# Social cost of carbon

- Net present value of climate impacts due to increasing emissions by one tonne.

# Some estimates

Study	Value (\$/tCO <sub>2</sub> )
Stern (2007)	\$85/tCO <sub>2</sub>
Nordhaus (2008)	\$7/tCO <sub>2</sub>
UK Government Economic Service (2002)	\$30/tCO <sub>2</sub>
Obama Administration (2009)	\$21/tCO <sub>2</sub>
Reference values	Value (\$/tCO <sub>2</sub> )
EU emissions trading price	\$16/tCO <sub>2</sub>
RRGI auction price	\$3/tCO <sub>2</sub>

# Social rate of discount

$$r_t = \delta + \eta g$$

where

$r_t$  is the social rate of discount

$\delta$  is the pure rate of time discount

$\eta$  is the elasticity of the marginal utility of consumption

$g$  is the rate of growth in per capita consumption.

# The difference

Study	$\delta$	$\eta$	g	r
Stern	0.1	1	1.3	1.4
Nordhaus	1.5	2	2	5.5

# Why does it matter?

- Take \$100 a century from now. How much is that worth today?
- At a discount rate of 1.4%, \$100 a century from now is worth \$24.66 today.
- At a discount rate of 5.5%, \$100 a century from now is worth \$.41 today.

## Another difference

- Stern (2007) thinks atmospheric concentrations should be prevented from exceeding 2°C.
- Nordhaus (2008) finds that the B-C ratio for limiting temperature change to 2°C  $\approx$  0.8. He thinks it's ok to let temperature exceed 3°C.
- So, is discounting the real issue?

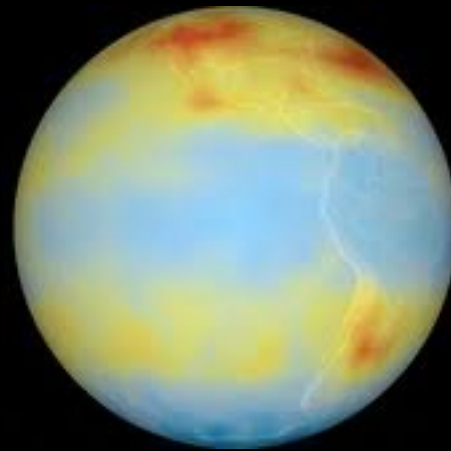
# Postscript: Stern Sensitivity

(Cost equivalent of losing %GDP each year;  $\delta = 0.1$ )

$\gamma$	$\eta$	Baseline climate; market impacts + risk of catastrophe	Baseline climate; market impacts + risk of catastrophe + non-market impacts	High climate; market impacts + risk of catastrophe + non-market impacts
<i>Low</i>	<i>1</i>	<i>5.0</i>	<i>10.9</i>	<i>14.4</i>
	1.5	2.9	6.5	10.2
<b>High</b>	1	6.0	14.2	21.9
	1.5	3.4	8.7	15.3

What can we do?

# Why International Agreement is Needed



GHGs mix in the atmosphere.

# But Negotiating an International Agreement is Difficult

- Free riding.
  - Trade leakage.
  - Global energy markets.
  - Common but differentiated responsibilities.
  - Historic responsibilities.
  - Countries affected differently by “gradual” climate change.
  - “Abrupt” climate change uncertain.
  - Long lag between reducing emissions and mitigating climate change.
- All of this made difficult because costs of reducing emissions high, at least beyond some point.

# Kyoto Protocol



# Kyoto Protocol

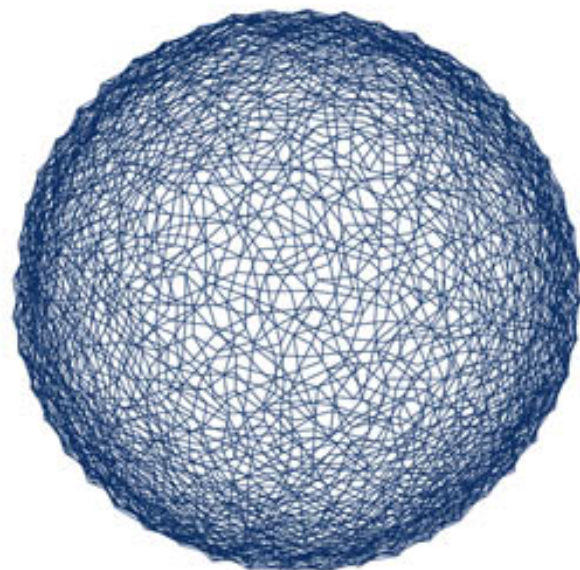
- Sets emission limits 2008-2012 for Annex I countries only.
- Applies to CO<sub>2</sub>, CH<sub>4</sub>, N<sub>2</sub>O, HFCs, PFCs, SF<sub>6</sub>.
- Allows trading.
- Clean development mechanism.
- Enters into force after being ratified by at least 55 countries making up at least 55% of Annex I CO<sub>2</sub> emissions.

# Problems

- Non-participation of the U.S.
- Non-compliance by Canada and...
- Compliance, perhaps, by Japan, but trading may not reduce emissions (“hot air”).
- Very modest; can it be made more ambitious?
- Much too short term.
- No follow-on agreement.

# Kyoto enforcement is weak

- Penalty of 1.3 added in Bonn, but:
  - Defers punishment.
  - Future emission limits endogenous.
  - Relies entirely on self-punishment.
- Withdrawal of right to trade--credible?
- Article 18 requires that “procedures and mechanisms...entailing binding consequences...be adopted by means of an amendment.”
  - Amendments apply only to parties that ratify, subject to  $\frac{3}{4}$  of parties to Kyoto ratifying.



COP15  
COPENHAGEN  
UN CLIMATE CHANGE CONFERENCE 2009

# The negotiations



# Copenhagen Accord



Opposed by Bolivia, Cuba, Nicaragua, Sudan, Tuvalu, and Venezuela.

# Brazil's submission

- Brazil understands the Accord to be a political instrument, an important step for facilitating the negotiations within the [Kyoto Protocol] and [Framework Convention], with a view to their successful conclusion during COP-16 in Mexico. Brazil does not consider the Accord as a stand-alone, plurilateral instrument that could engage only a group of countries... The global nature of the climate change challenge demands a true multilateral response....

# Diagnosis

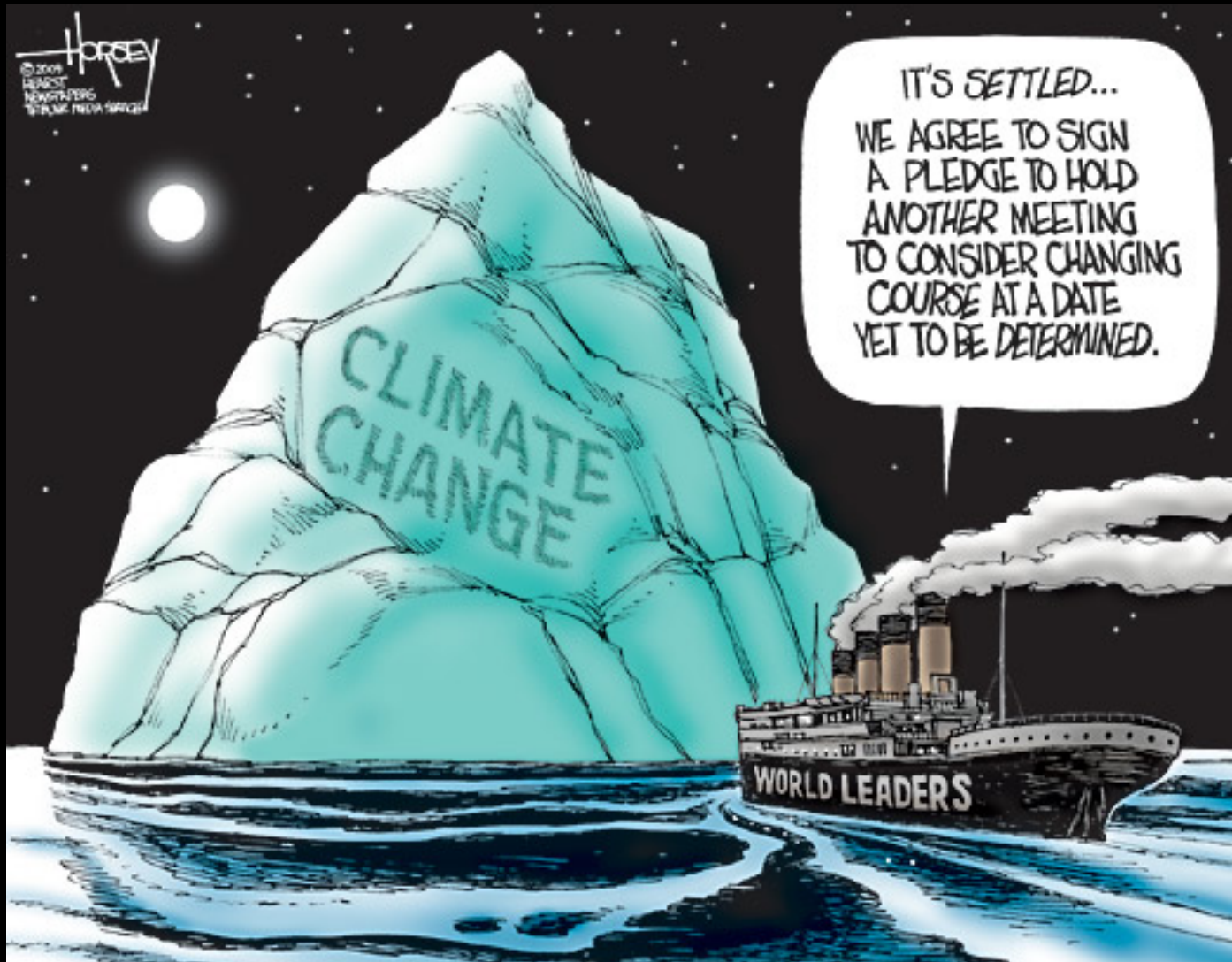
- Why the failure (if you think Copenhagen was a failure)?
  - The process?
    - Requirement for unanimity under the UNFCCC.
    - Too many negotiators?
  - The approach?
    - Find the right formula?
    - Try a different approach?

# Cancun 2010



Kept hope alive

# Cancun's success



Next stop

Durban



# When will we succeed?

