Climate Coordination & Fossil-Fuel Traps

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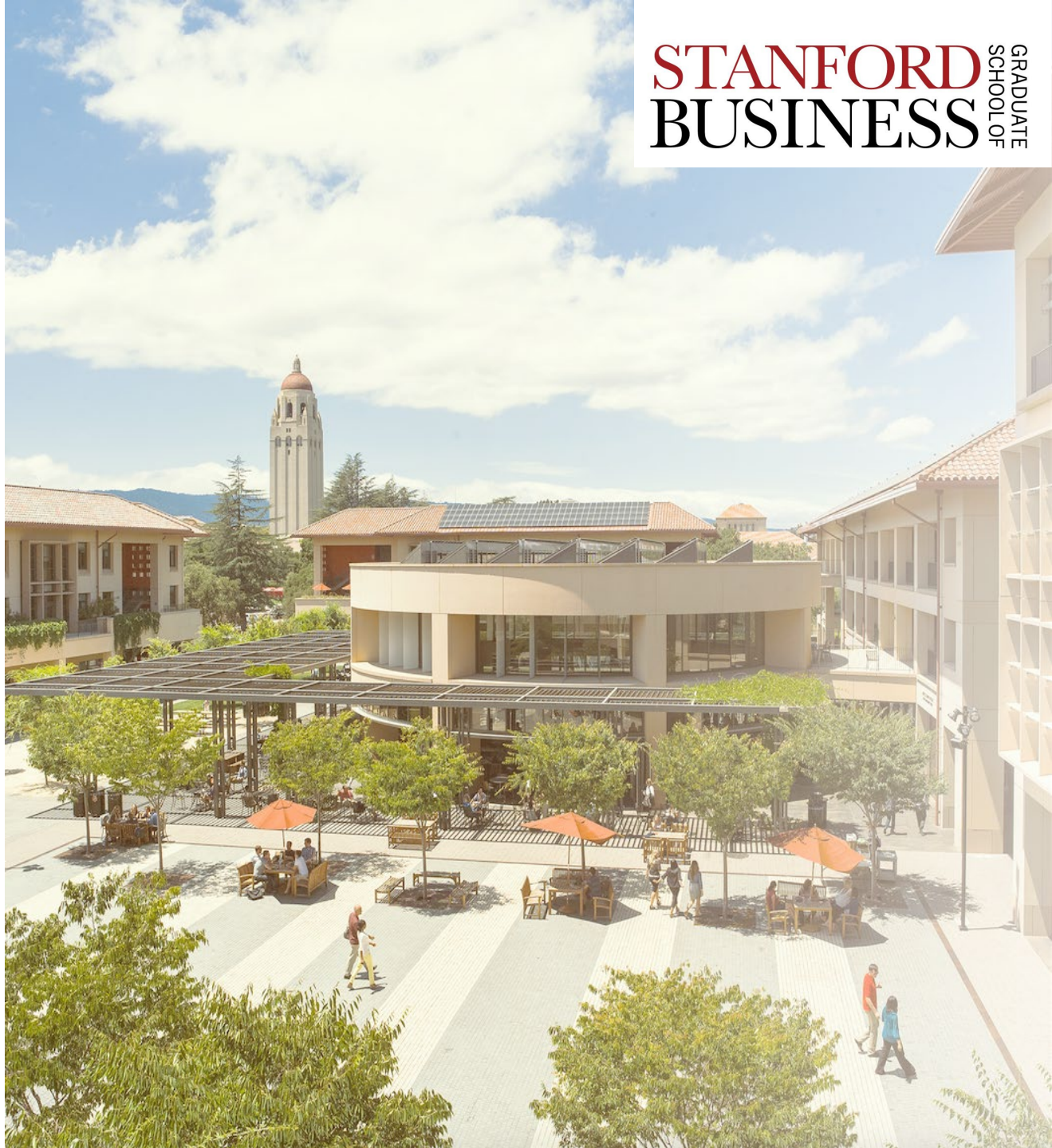


STANFORD BUSINESS GRADUATE SCHOOL OF

Climate change as a «free-rider game»

Foreign country

Home country

	Business as usual	Cutting emission
Business as usual:		
Cut emission:		

Climate change as a «free-rider game»

Foreign country

Home country

	Business as usual	Cutting emission
Business as usual:	✓	
Cut emission:		?

A better equilibrium requires investments in green technologies
(Harstad, Lancia, and Russo, 2019 and 2022)

Climate change as a coordination game?

	Brown policies	Green policies
Brown capital	✓	
Green capital		?

Green «Catch 22»

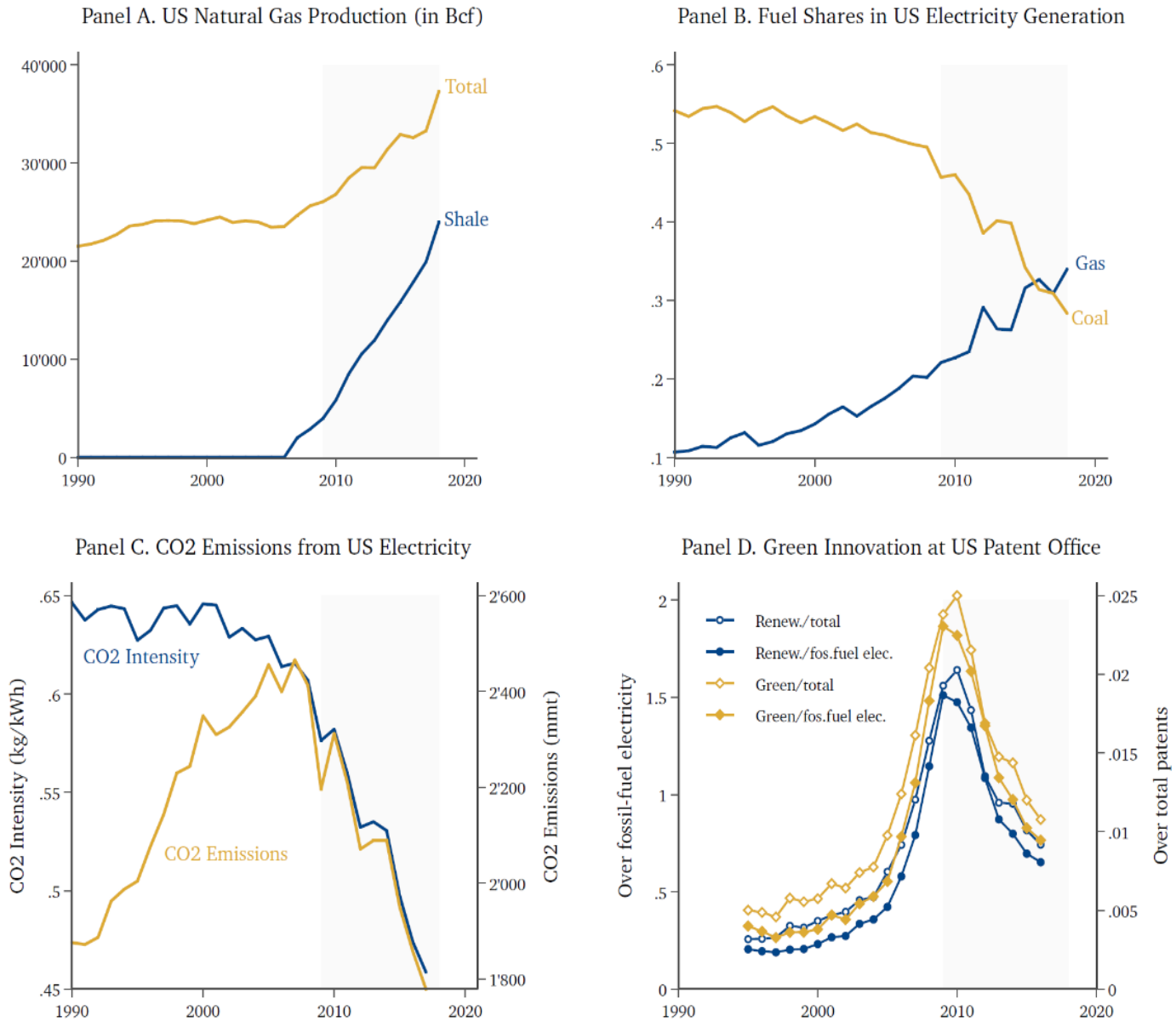
- The world has not been able to address climate change because we are stuck in a “brown trap”:

1) **Firms won’t invest in green technologies** and disinvest from polluting sectors unless there is political support for ambitious climate change policies, making the switch profitable.
2) **As long as capital is sunk in polluting** industries, and voters are employed by these same industries, there is no political support for the necessary reforms.

Fossil-fuel traps

- Renewables and fossil fuels are “substitutes”:

1) Investments in **renewables** pay off if the production of energy from fossil fuels is reduced.
2) But **fossil-fuel production** continues as long as investments in renewables (as a substitute) has not taken place



Acemoglu et al. (2023)

Dilemma

1) More natural gas can replace coal, and coal has a larger carbon-content than natural gas.

   This effect is most important in the short term.

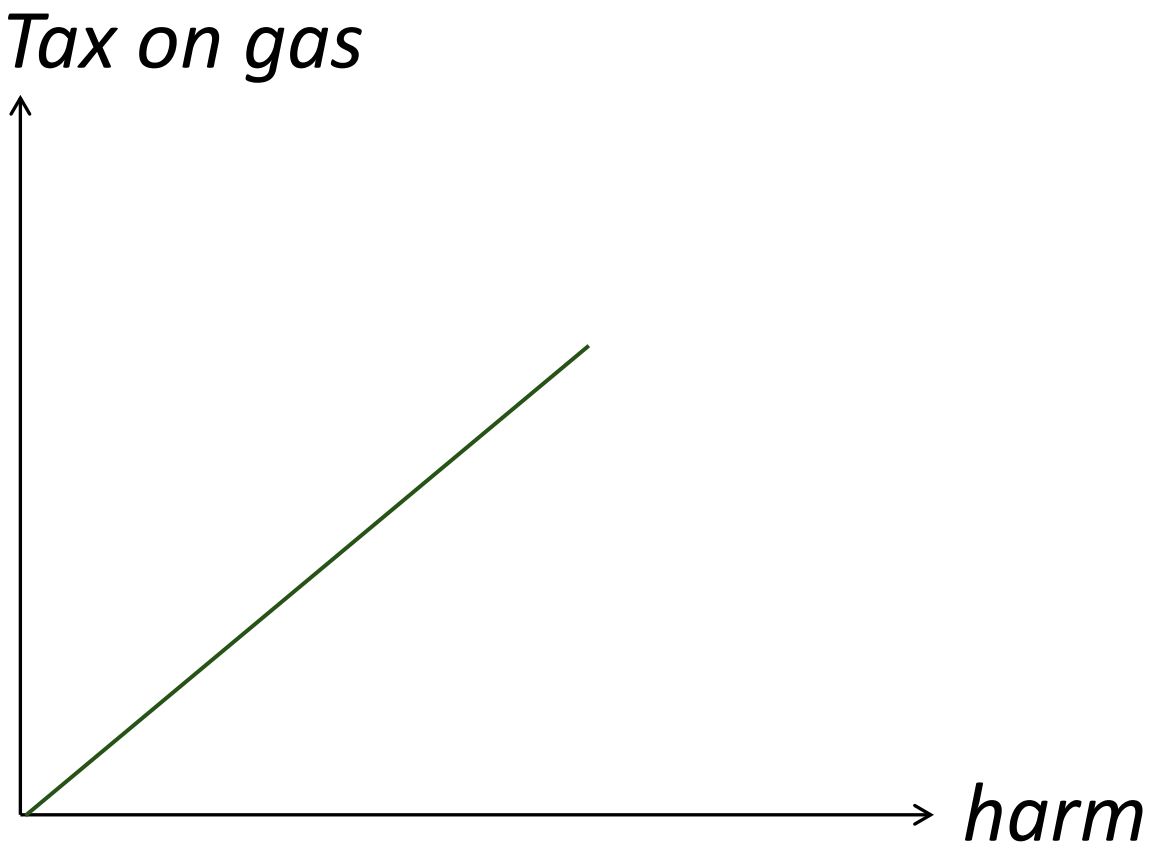
2) When more gas is anticipated, investments in renewables fall.

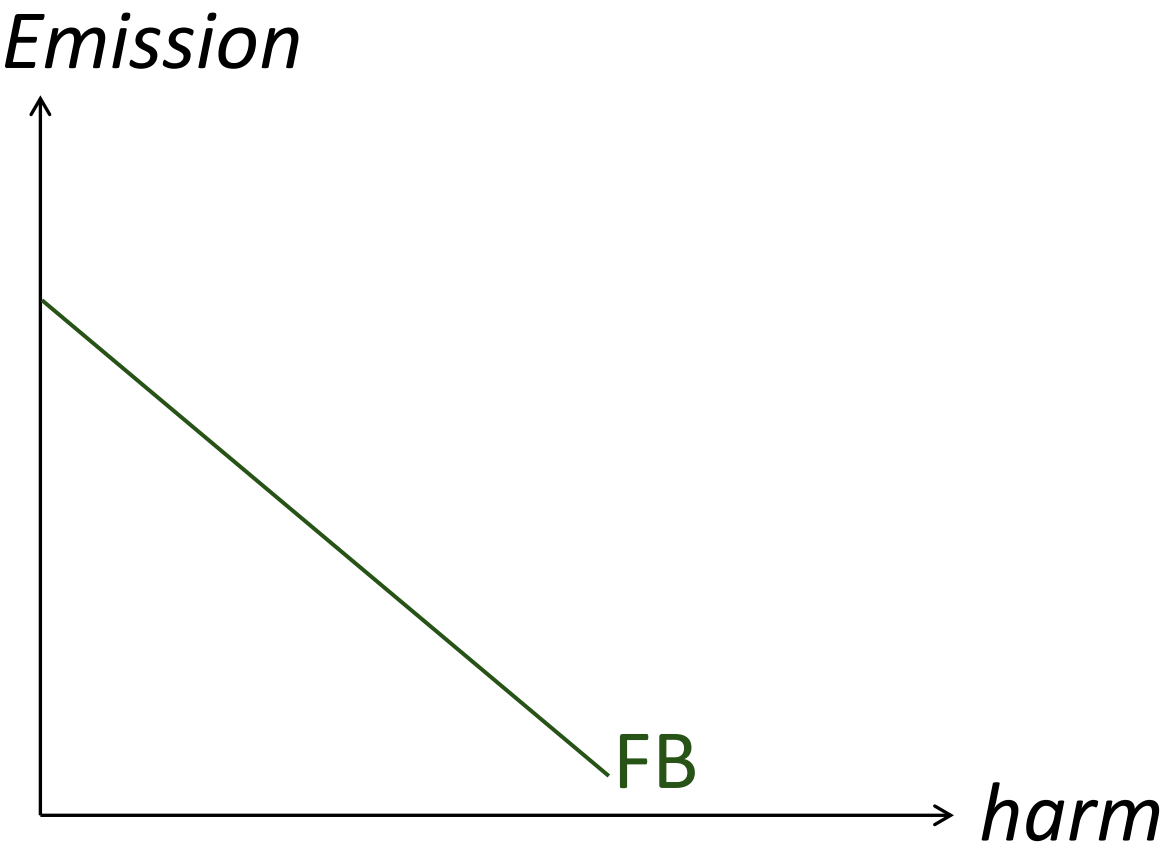
   In the long run: Gas replaces renewables, instead of coal.

- "The Gas Trap: Outcompeting Coal vs. Renewables"

  (Harstad and Holtsmark, *Journal of Political Economy*)

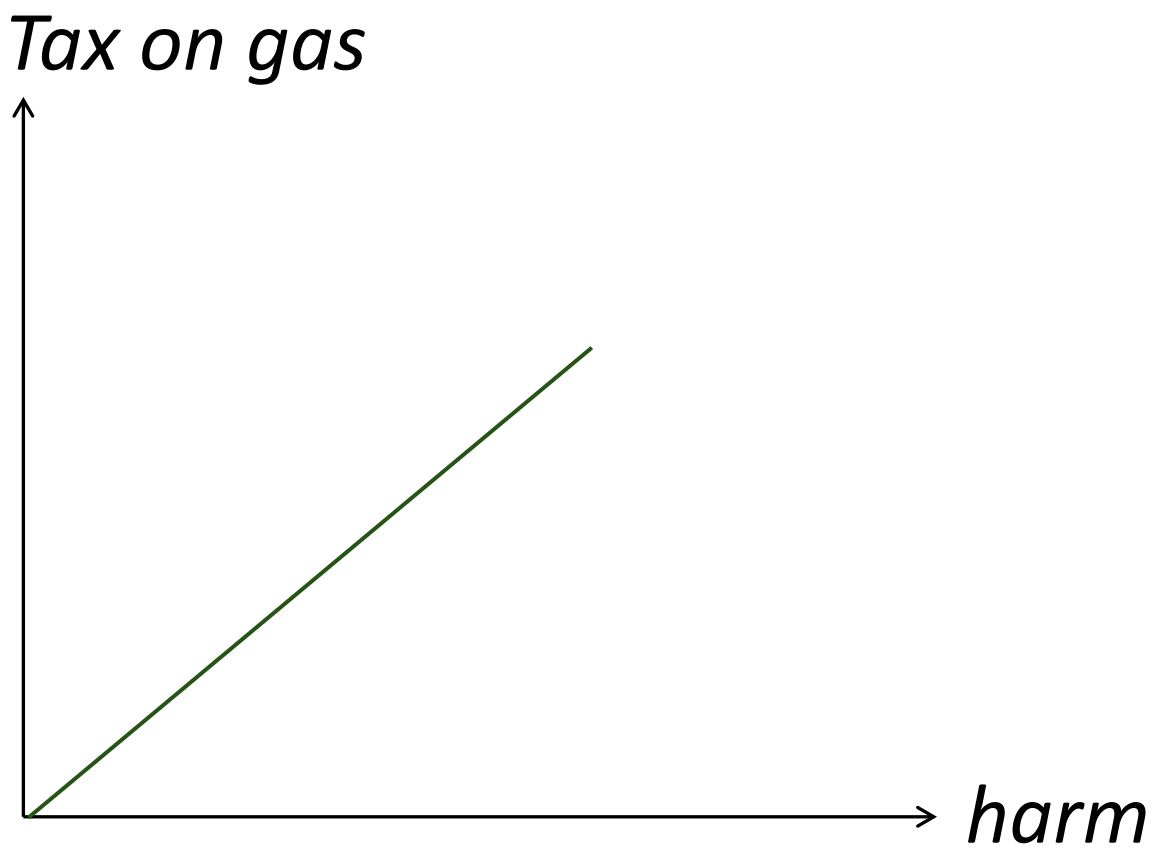
First Best

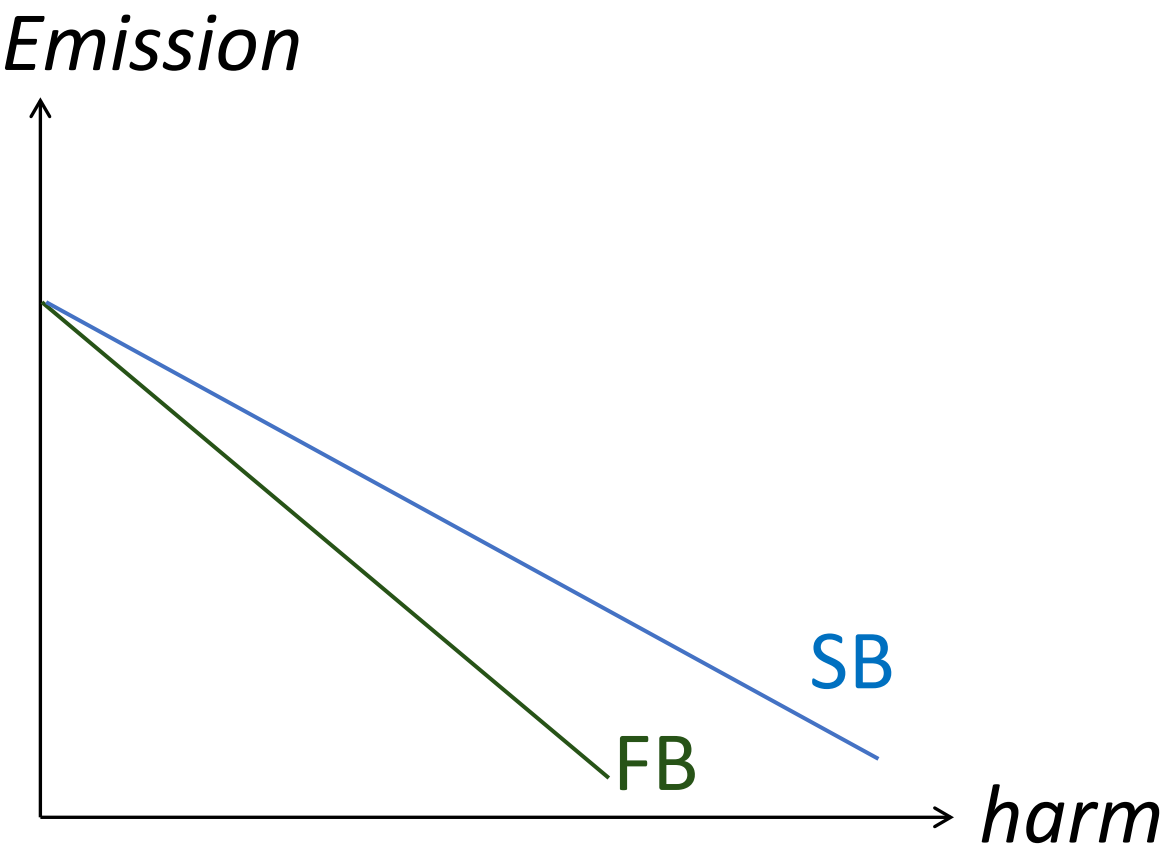




"First best" is implemented by green taxes on fossil fuels. The larger is the harm from climate change, the **larger** is the tax and the **smaller** is the emission.

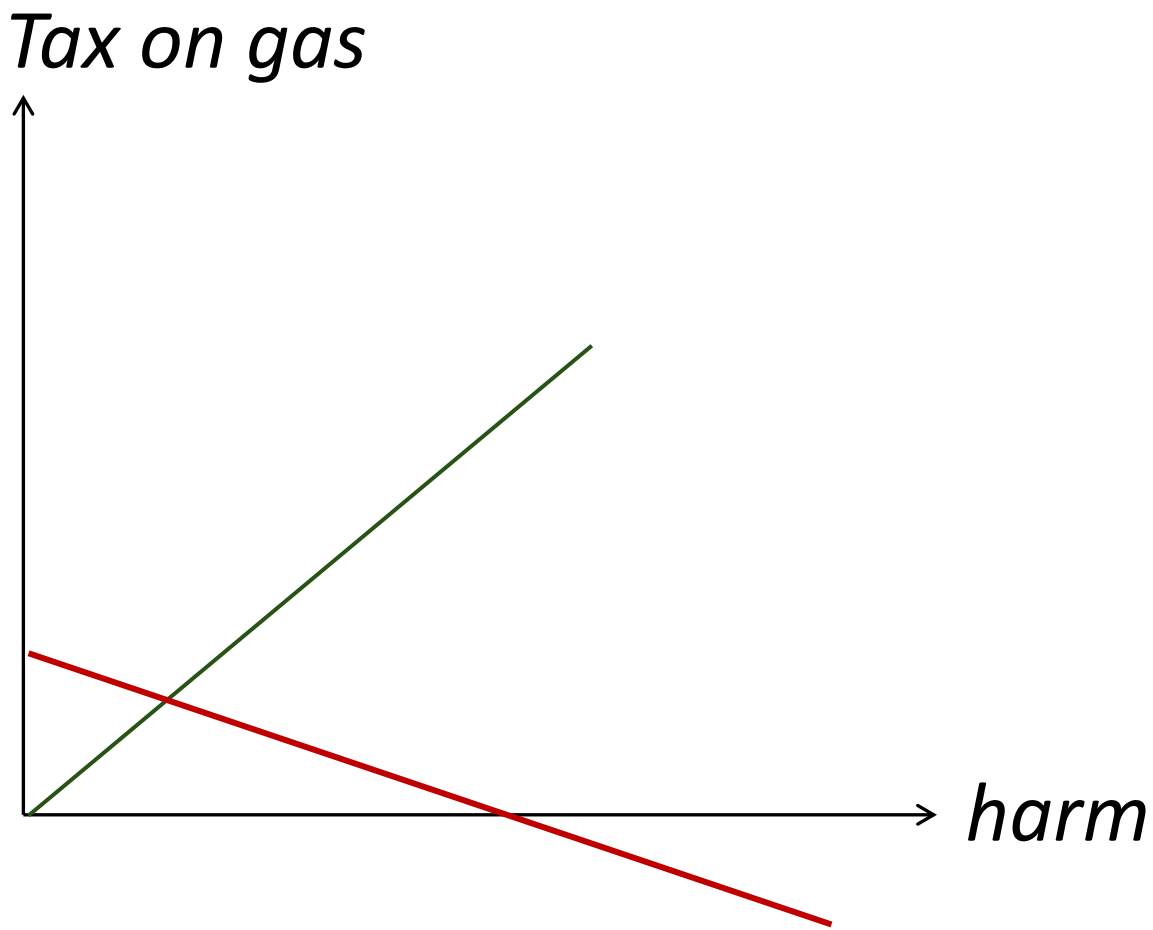
Second Best (Commitment)

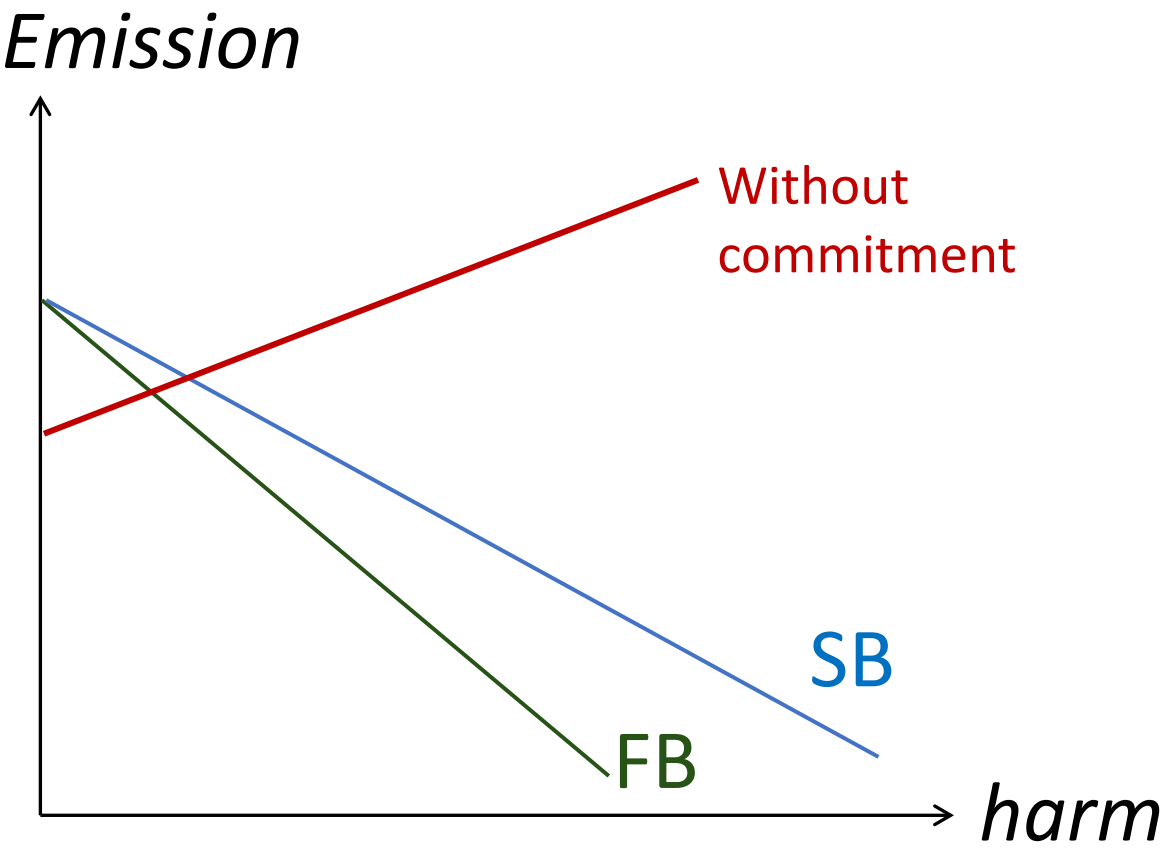




This holds also in the “Second best”, where there is no global tax on coal.
(In this case, however, total emission is somewhat **larger**.)

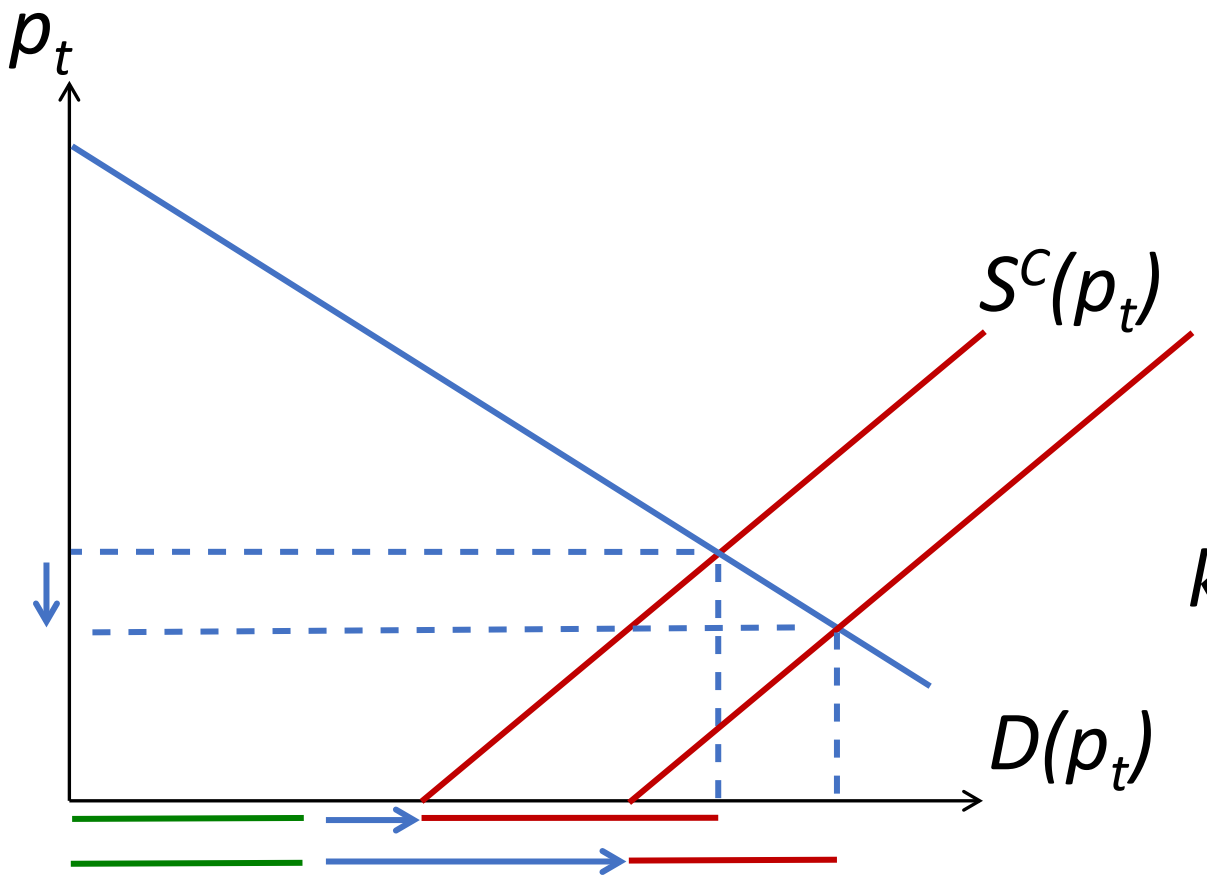
Equilibrium (without commitment)



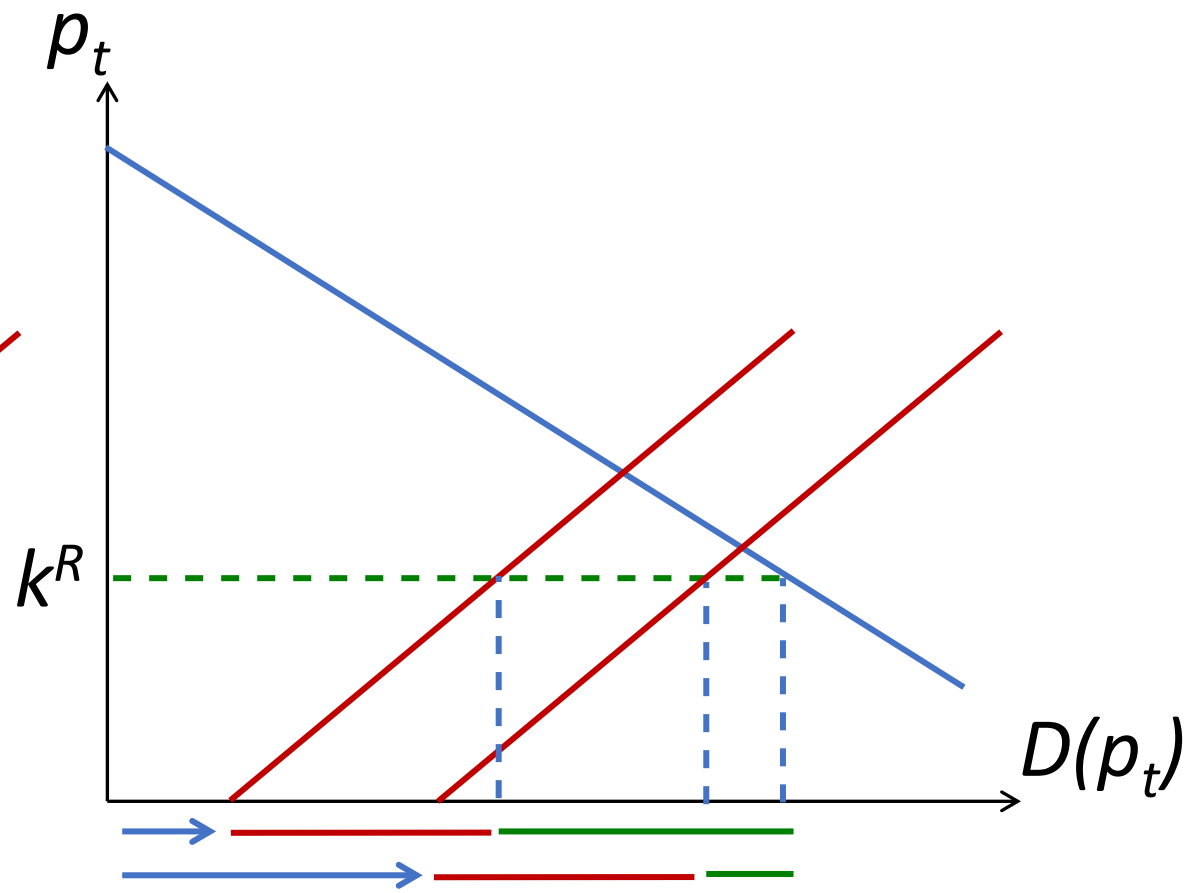


With the temptation to outcompete coal, and without the ability to commit, the outcome is **reversed**: Harm → More gas → Less Renewables → **Larger** emission.

Intuition (pedagogical example)

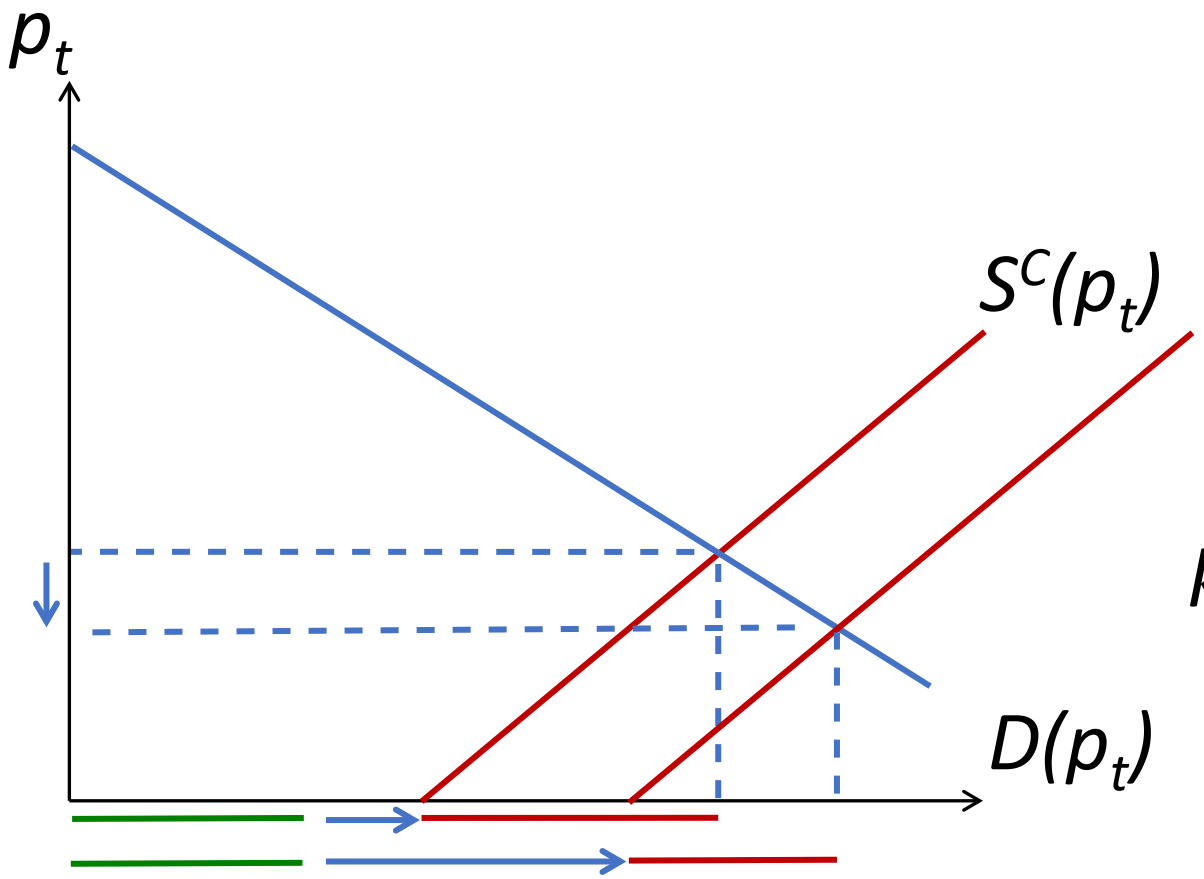


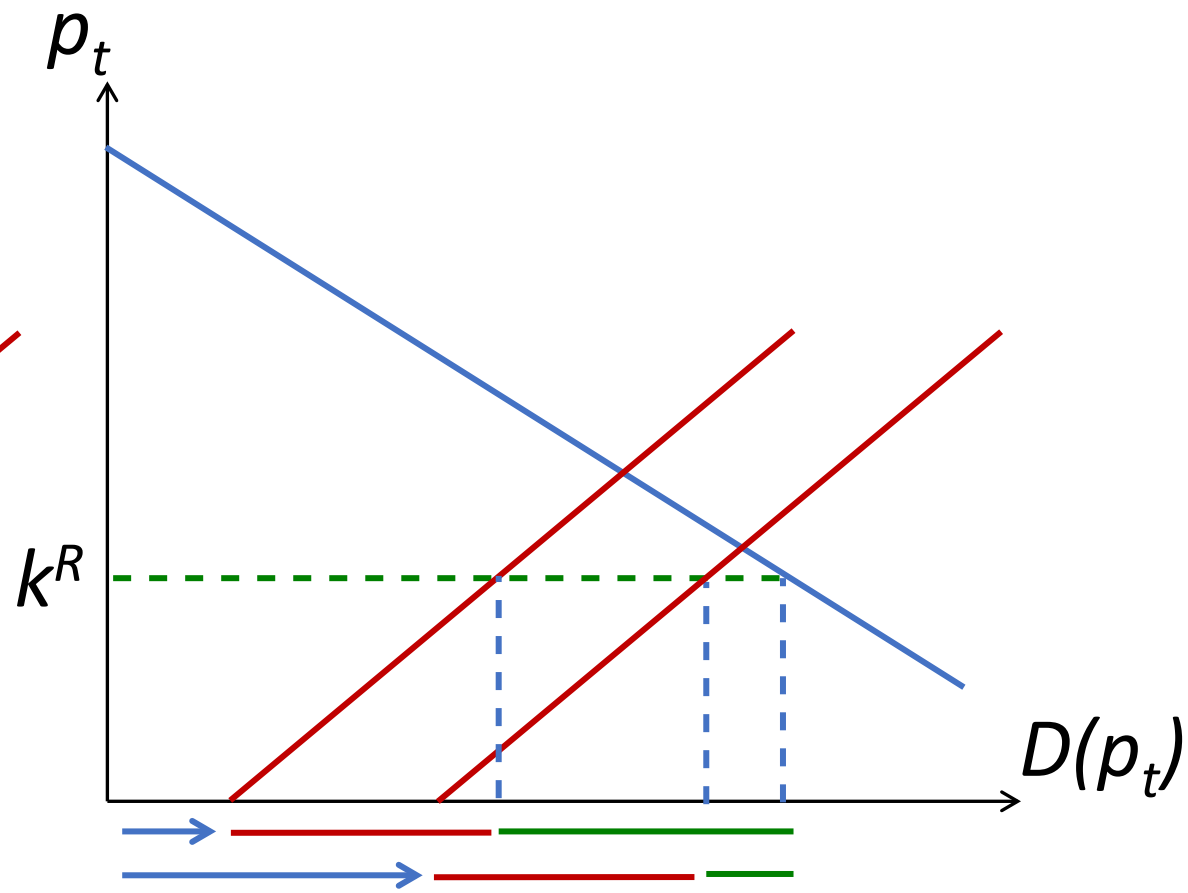
Short term: Stock of **renewables** is given, so more **gas** crowds out **coal**.



Long term: More **gas** crowds out **renewables**, not **coal**.

The Gas Trap? Possible remedies





Regulating search & exploration limits long-term production quantities and strengthens the expectation that renewables can be profitable.

Empirically relevant? For Europe?

Electricity sources	%	e^j	ε^j_{ST}	ε^j_{LT}
Coal	17.1	1.0	2.4	2.4
Gas – pipes	16.7	0.5	0.2	0.5
Gas – LNG	4.2	1.3	2.0	2.0
Oil	1.5	0.8	0.3	1.0
Renewables	34.8	0.0	0.0	3.0
Nuclear	18.7	0.0	0.0	3.0

- Estimates for the price elasticity ε^j vary with the time horizon.

1. More gas reduced emission – in the short term only:

$$\partial E/\partial x^G \mid_{ST} = -0.37 \text{ vs. } \partial E/\partial x^G \mid_{LT} = 0.26.$$

2. If Norway's SCC:107→240€/t, its gas supply should **decrease 13%**.
3. Without commitment, it **increases 12%**. Total emission changes by the same (relative to emission from Norway's gas).
4. Noncommitment causes **19-45% more** gas and, thus, emission.

Generalizations strengthen the results

1. There can be non-cooperating gas producers and cooperating coal producers.
2. Countries and the coalition can produce multiple types of fuels, and emission contents can vary.
3. There can be many periods
4. Parameters can vary over time
5. With **learning by doing** in k^R, M would like to commit to lower x^G, but the non-commitment outcome is unchanged.
6. With **exhaustible resources**, M may deplete faster, as a commitment to reduce x^G_{t+1}.

Climate change is a coordination game

	Brown policies	Green policies
Brown capital	✓	
Green capital		?

Solutions

1) Pay attention to how you affect expectations!
   - ➢ Expectations are self-fulfilling.
   - ➢ If investors and other countries *expect* that the Paris Agreement will fail, it *will*.
   - ➢ If expectations change, investments change.
   - ➢ If investors trust that green/renewable investments will be profitable and be supported by policies, while brown investments will not, green investments will accelerate.
   - ➢ All public policies/investments are interpreted as signals: They reveal intentions and beliefs, and they affect expectations and investments.
2) Pay attention to how you affect expectations!