Inefficient Policies in the Green Transition

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Two Approaches to Climate Policy

Taxing Pollution

Subsidizing Green Technologies

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Two Approaches to Climate Policy

Economists recommend taxing pollution

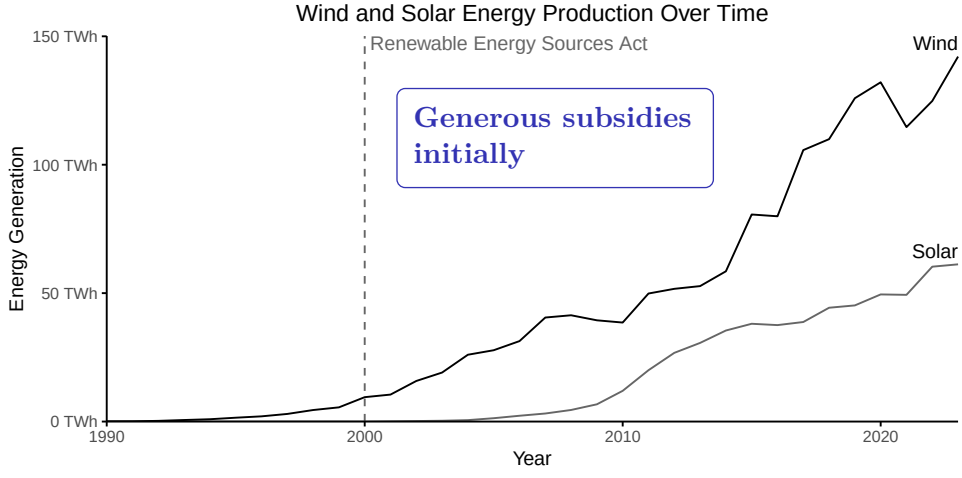
- Statically, it reduces emissions cost-effectively
- Dynamically, it encourages economic actors to invest in clean technologies if the environmental harms justify paying the cost of transition

Reality: only 1% of global emissions are taxed at the recommended level (World Bank)

Variation across country, and **within country** over time.

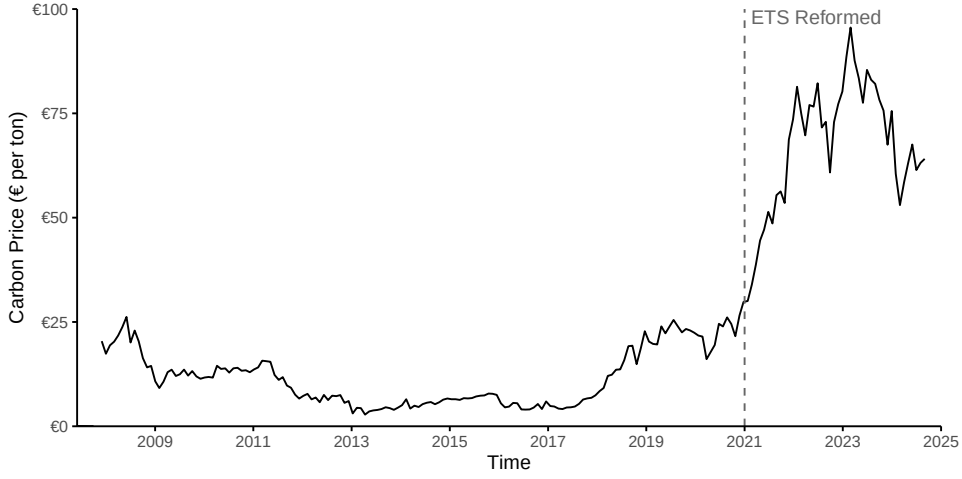
Pattern: subsidies + low taxes initially → high taxes later.

Germany – Renewable Energy Sources Act (2000)



EU Emissions Trading System (ETS) starts in 2005, reformed in 2021

Germany prices carbon in the heating and transportation sectors in 2021



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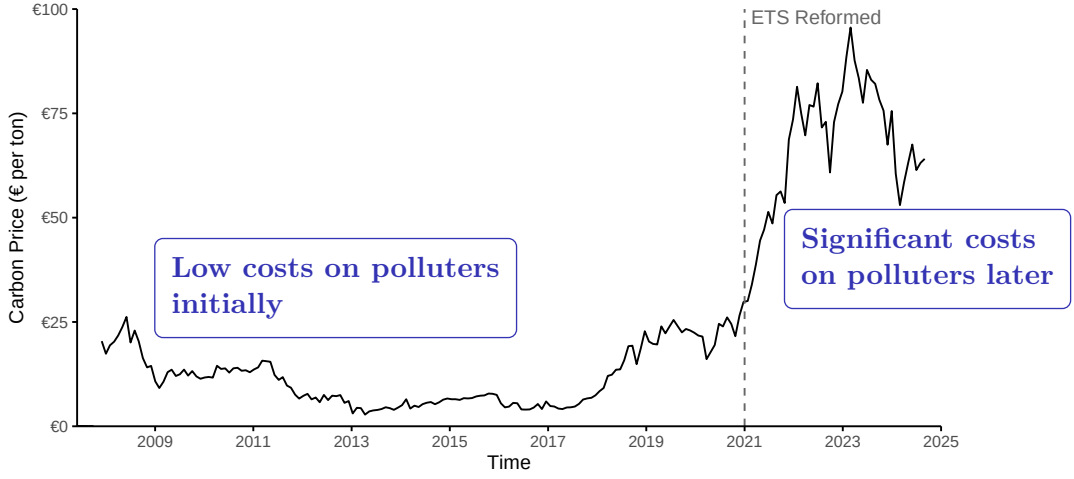


Questions

Puzzle: generous subsidies + low carbon taxes are hard to reconcile with the theory of optimal environmental policy.

Policy sequencing argument: subsidies serve to **build a coalition** today, and relax political opposition to carbon pricing tomorrow (Meckling et al 2015, 2017; World Bank 2024).

> "We need to **disrupt the political power of carbon polluters before** we can meaningfully reshape economic incentives" (Mildenberger and Stokes 2020).

What we do not know:

1. Under what conditions the policy sequencing strategy is feasible.
2. How do subsidies work? How should they be designed?
3. Can this logic explain the empirical pattern?

This Paper

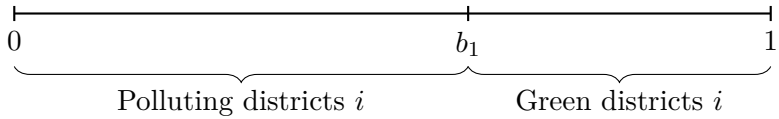
Dynamic political economy framework to address the following questions:

1. Under what conditions is the policy sequencing strategy even feasible?
   - How do political and economic conditions, such as political polarization and the productivity of green technologies, affect the feasibility of the strategy?
2. Can it help us rationalize the dynamic path of pollution taxation?

This is the **first paper** to develop a **dynamic model of climate policymaking** in which policy **reshapes the distribution of political power** among economic sectors.

The Model

The Model – Economy



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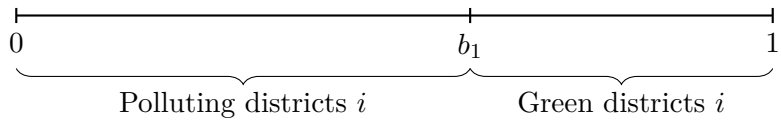

Production function is Cobb-Douglas with $\alpha = \frac{1}{2}$ using numéraire good and capital.

- Polluting technology produces y at cost $\frac{1}{2}y^2$.
- Green technology in district i produces $\boldsymbol{Ai}y$ at cost $\frac{1}{2}y^2$.
- $A > 1$ measures the productivity of green technology.

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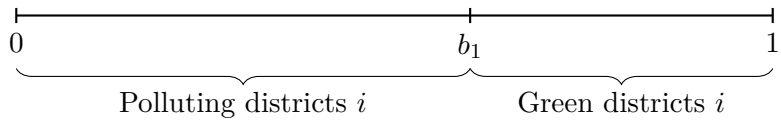

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Polluting production generates carbon emissions: producing y units $\rightarrow$ emitting y tons.

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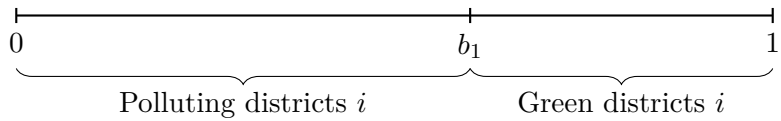

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- $A > 1$ measures the productivity of green technology.

Polluting production generates carbon emissions: producing y units $\rightarrow$ emitting y tons.

Polluting district i can invest in green capital and transition at cost $c \geqslant 0$.

The Model – Policies

Carbon tax $\tau \in [0, 1]$.

- Polluting districts pay τy.
- Green districts are not affected.

Investment subsidy $s \geqslant 0$.

Lump-sum tax or transfer T.

The Model – Policies

Income of district i:

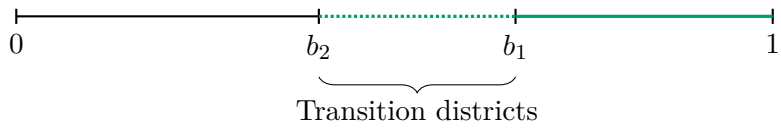
Polluting: $\underbrace{(1-\tau_1)y_1 - \frac{1}{2}y_1^2}_{\text{Period-1 Income}} + \underbrace{\delta}_{\substack{\text{Discount}\\ \text{Factor}}} \times \underbrace{\left[(1-\tau_2)y_2 - \frac{1}{2}y_2^2\right]}_{\text{Period-2 Income}} + \text{Transfer}$

The Model – Policies

Income of district i:

Polluting: $\frac{1}{2}(1 - \tau_1)^2 + \frac{\delta}{2}(1 - \tau_2)^2 + T,$

The Model – Policies



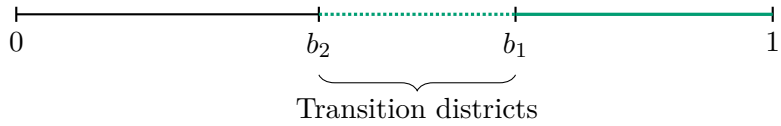
Income of district i:

Polluting: $\frac{1}{2}(1-\tau_1)^2 + \frac{\delta}{2}(1-\tau_2)^2 + T,$

Transition: $\frac{1}{2}(1-\tau_1)^2 + \text{Subsidy} - \text{Capital Cost}$

$+ \text{Period-2 Income using Green Technology} + T$

The Model – Policies



Income of district i:

Polluting: $\frac{1}{2}(1-\tau_1)^2+\frac{\delta}{2}(1-\tau_2)^2+T,$

Transition: $\frac{1}{2}(1-\tau_1)^2+s-c+\frac{\delta A}{2}i+T,$

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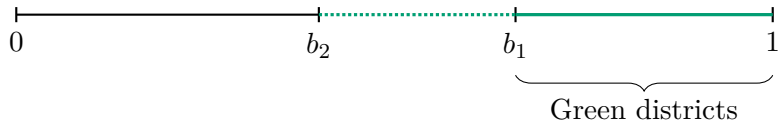

Income of district i:

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Transition: $\frac{1}{2}(1-\tau_1)^2+s-c+\frac{\delta A}{2}i+T$,

Green: Period-1 Income + Period-2 Income + Transfer.

The Model – Policies

Income of district i:

Polluting: $\frac{1}{2}(1-\tau_1)^2+\frac{\delta}{2}(1-\tau_2)^2+T,$

Transition: $\frac{1}{2}(1-\tau_1)^2+s-c+\frac{\delta A}{2}i+T,$

Green: $\frac{A}{2}i+\frac{\delta A}{2}i+T.$

The Model – Politics

There are two proposers: G and B.

Initially taxes and subsidies are zero, and G is the agenda-setter.

In each period $t = 1, 2$:

1. Proposer chooses a carbon tax τ_t; in the first period, also a subsidy s.
2. If a majority of districts prefer it to the status quo, it is implemented, and becomes the new status quo.
3. Districts make production and investment decisions.
4. The next period proposer is determined: with probability ρ the current proposer is replaced by B.

In the second period T is automatically determined to balance the budget.

Equilibrium selection. If the first-period policy is blocked then districts expect zero taxes in the second period.

The Model – Preferences

Agents maximize discounted expected utility with discount factor δ.

Legislators only care about consumption π_{it}.

Proposer P's payoff in period t is

$$W_P = \text{Aggregate Consumption} - \text{Environmental Damages}.$$

The Model – Preferences

Agents maximize discounted expected utility with discount factor δ.

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Proposer P's payoff in period t is

$$W_P = \underbrace{\int_0^1 \pi_{it}\, di}_{\substack{\text{Aggregate} \\ \text{Consumption}}} - 1_{P=G}\lambda \underbrace{\int_0^{b_t} y_{it}\, di}_{\text{Emissions}}.$$

λ is the (subjective) **social cost of carbon**.

Results

Policy without Politics

Proposition
If the proposer is a dictator in both periods then carbon taxes equal the social cost of carbon and the subsidy is not used.

Why? Setting the carbon tax equal to the social cost of carbon

- Statically, it reduces emissions cost-effectively
- Dynamically, it encourages firms to invest if the social cost of carbon justifies paying the cost of transition

Subsidies are an **inefficient** instrument for reducing carbon emissions.

Analysis of the Full Model

1. Second Period Policies
2. Investment Decisions
3. First Period Policies

Second Period Policies

Two cases:

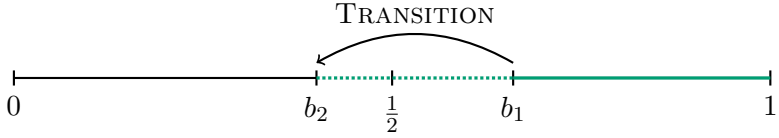
1. Polluting districts are still a majority: $b_2 > \frac{1}{2}$

- If the proposer is G, they will keep the status quo.
- If the proposer is B, they will set the carbon tax to zero.

2. Green districts are a majority: $b_2 \leqslant \frac{1}{2}$

- If the proposer is G, they will raise the carbon tax to λ if it is below that level.
- If the proposer is B, they will keep the status quo.

Who Transitions?



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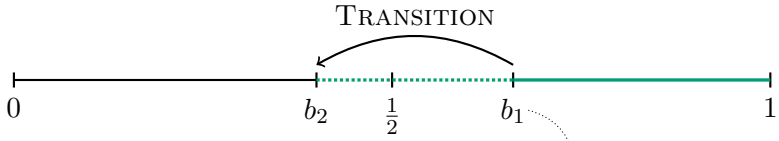

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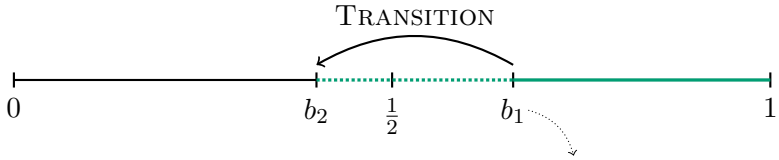

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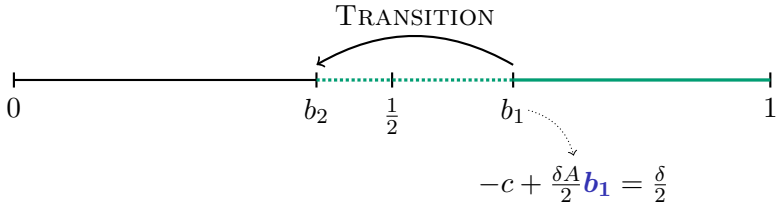

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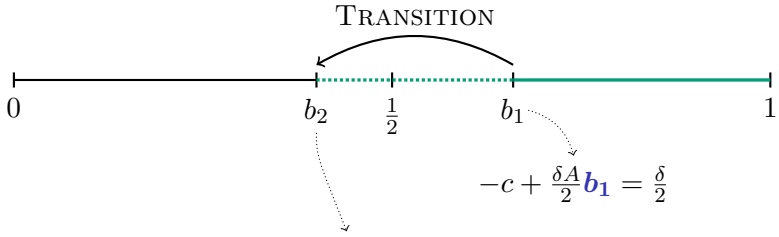

Net Benefit of Transition = Period-2 Income in Polluting Sector

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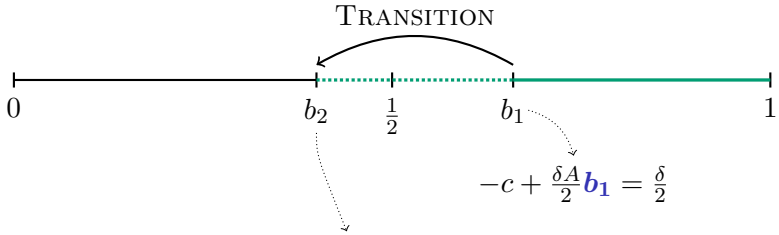
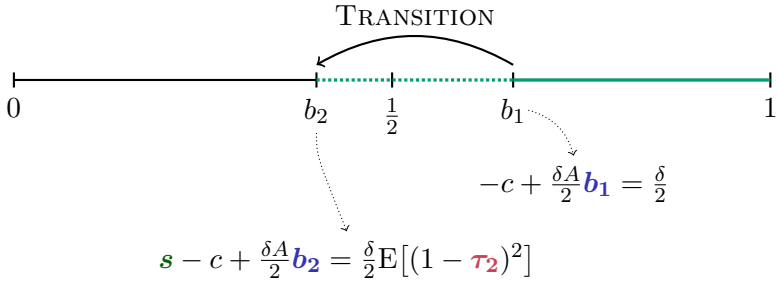


Subsidy – Cost of Investment = Discounted Period-2 Income

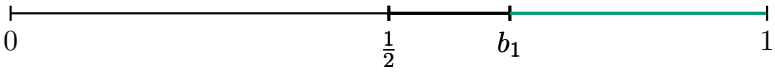
+ Discounted Period-2 Income Net of Expected Carbon Tax

Who Transitions?



Building a Coalition

Polluting districts are a majority, so a **winning coalition** must include some of them.



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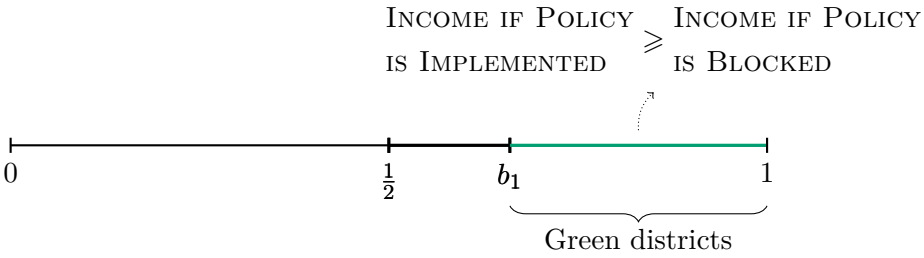

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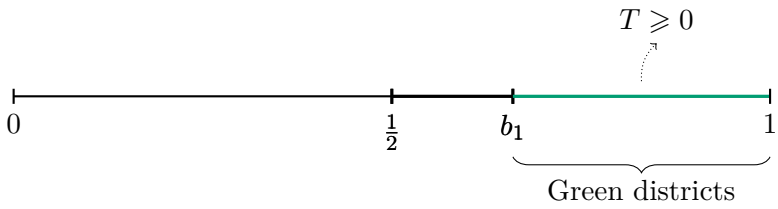

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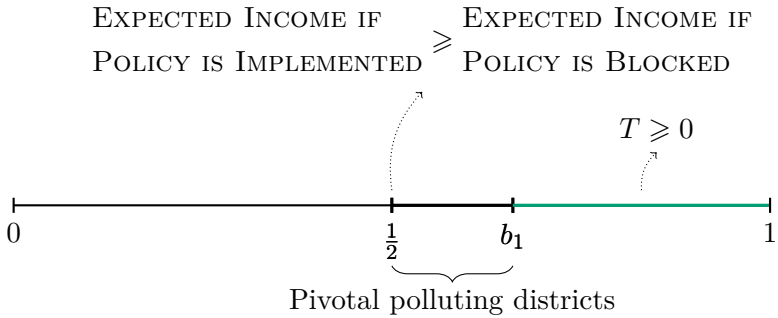

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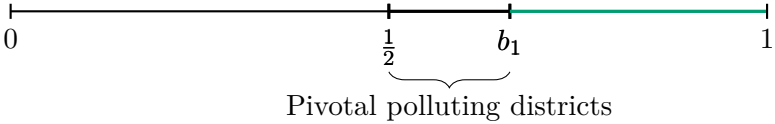
$$\frac{1}{2}(1-\tau_1)^2 + s - c + \frac{\delta A}{2}\frac{\mathbf{1}}{\mathbf{2}} + T \geqslant \frac{1}{2} + \frac{\delta}{2}$$

$$T \geqslant 0$$



Pivotal polluting districts

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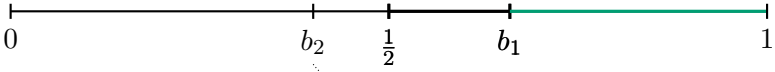

$$s - c + \frac{\delta A}{2}\boldsymbol{b_2} = \frac{\delta}{2}\mathrm{E}[(1-\tau_2)^2]$$

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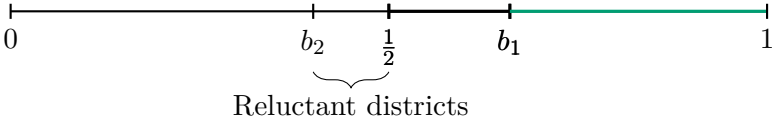

Political Constraints

Key distributive tension:

Polluting districts demand low taxes and generous subsidies.

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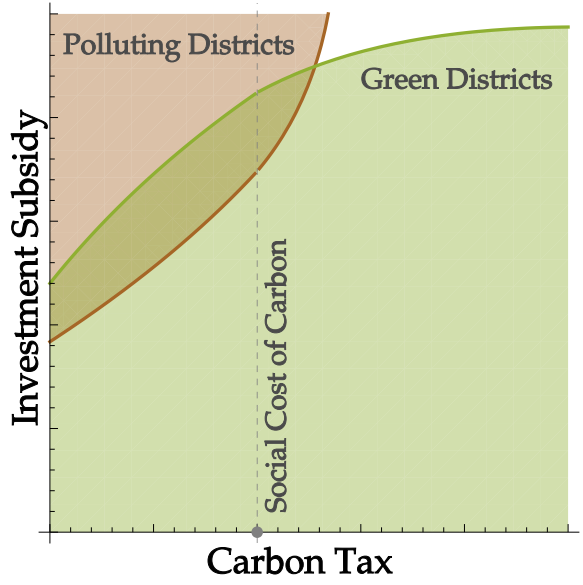

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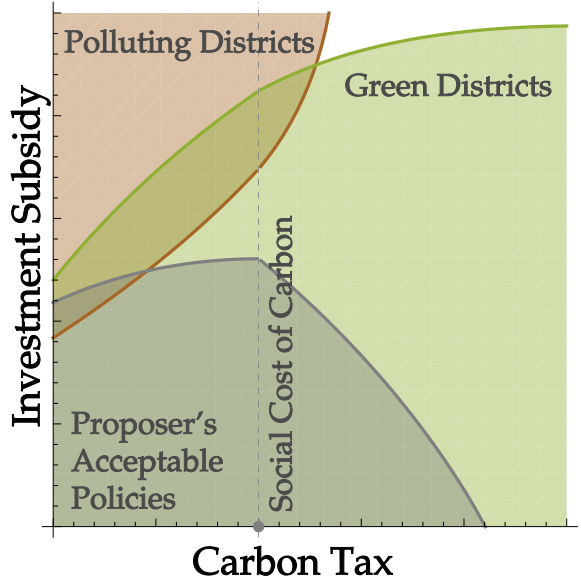
Also:

The proposer has to prefer a compromise policy over the status quo.



Why Are Carbon Taxes Low?

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In equilibrium either the first-period carbon tax is below the social cost of carbon and the subsidy is positive, or no climate policy is enacted.

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Why? Political constraints make taxes and subsidies **complements**.

Imposing costs on polluters today requires more subsidies as compensation: $\tau_1 \uparrow \Rightarrow s \uparrow$.

When is the Strategy Feasible?

Improving opportunities in the green sector or reducing capital costs.

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– Relaxes Political Constraint by Polluting Districts:

$$\frac{1}{2}(1-\tau_1)^2 + s - \boldsymbol{c} + \frac{\delta \boldsymbol{A}}{4} + T \geqslant \frac{1}{2} + \frac{\delta}{2}.$$

– Tightens Political Constraint by Green Districts:

$$T = \text{Carbon Tax Revenue} - \text{Cost of Subsidies} \geqslant 0.$$

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The first force dominates.

Result
If the political constraints are feasible and green technology improves or capital costs decrease, the political constraints are still feasible.

Political Polarization

Increasing the probability that a climate-unfriendly proposer takes power

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Affects both constraints through the expected transfer T:

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The effect is ambiguous.

Result
If the initial share of polluting districts is large enough, increasing the probability of turnover relaxes the constraints.

Social Cost of Carbon

Increasing the social cost of carbon

Affects both constraints through the expected transfer T:

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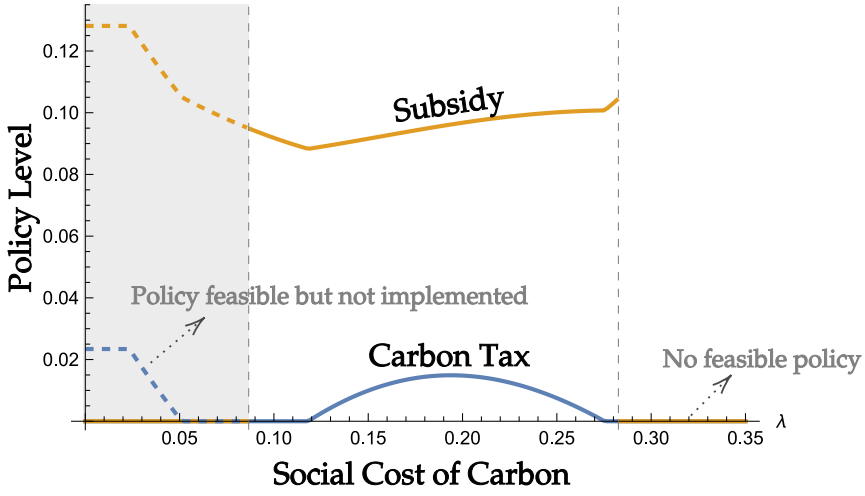
The effect is ambiguous.

Result
If the productivity of green technology is not too large, the constraints are feasible only if the social cost of carbon is not too large.

Social Cost of Carbon



Summary of Results

1. Under what conditions is the strategy feasible?
   - Carbon abatement technology needs to be sufficiently advanced.
   - The social cost of carbon cannot be too low nor too high.
   - The effect of polarization is ambiguous. The risk of the opposition taking agenda-setting power in the future can relax the political constraints today.

2. Can it help us rationalize the pattern of pollution taxation?
   - Yes. Carbon taxes are initially too low because there is a tradeoff between carbon prices and inefficient compensation.

Extensions

Targeted transfers and subsidies

- We can relax the assumption that transfers and subsidies are uniform.
- If we relax the perfect information assumption and adopt a mechanism design approach the optimal schedule is coarse, and the key friction persists.

Alternative policy instruments

- *Production subsidies.*
- *Standards and Feed-in Tariffs.* Equivalent to a revenue-neutral combination of carbon taxes and production subsidies.
- These instruments are inefficient but can also be used to start the policy sequence.

Broader Contribution

Theoretical contribution: incorporating political economy into climate policymaking.

- Microfounded and dynamic political constraints.
- The political power of industries is not fixed and policy can reduce it.

Political economy creates a **linkage between taxes and subsidies**:

- Taxing pollution requires subsidies to relax political constraints.
- Subsidies are affected by expectations of future pollution taxation.

Policy implications:

- *Some* inefficient policies are good because of their policy feedback effects.
- Framework for incorporating political constraints into cost-benefit analysis.