Inefficient Policies in the Green Transition

Juan Dodyk

Harvard

Two Approaches to Climate Policy

Taxing Pollution

Subsidizing Green Technologies

Two Approaches to Climate Policy

Economists recommend taxing pollution

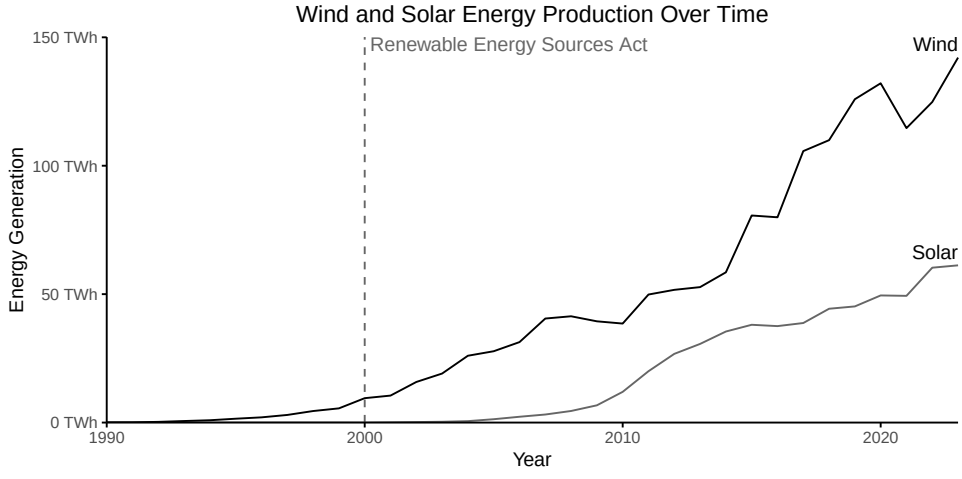
- Statically, it reduces emissions cost-effectively
- Dynamically, it encourages economic actors to invest in clean technologies if the environmental harms justify paying the cost of transition

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

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

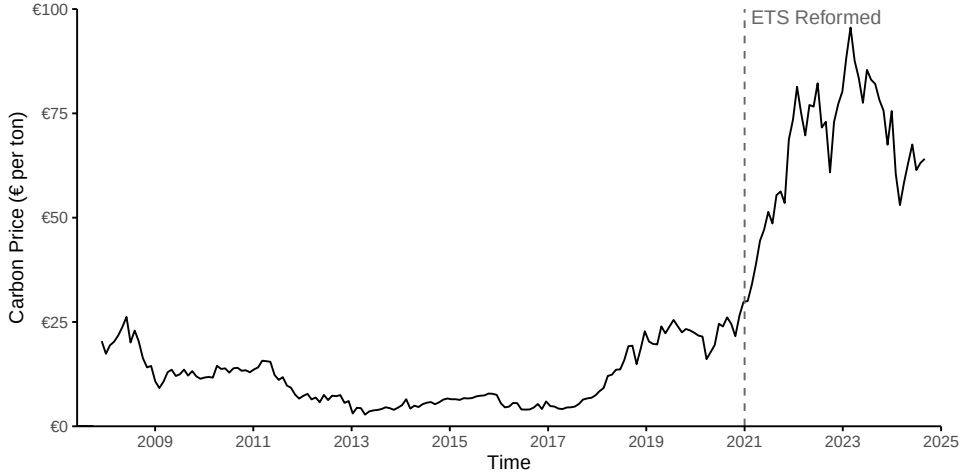
Pattern: subsidies + low taxes initially $\rightarrow$ high taxes later.

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



Canada – Project Green (2005)

Burning Our Money to Warm the Planet

Canada's Ineffective Efforts to Reduce Greenhouse Gas Emissions

Mark Jaccard, Nic Rivers,
Christopher Bataille,
Rose Murphy, John Nyboer and
Bryn Sadownik

Canada – Federal Carbon Price (2018)

Canada passed a carbon tax that will give most Canadians more money

By rebating the revenue to households, disposable income rises, which can be a boon for the Canadian economy

Prime Minister Justin Trudeau answers a question on Parliament Hill in Ottawa on Thursday, Oct. 25, 2018. Photograph: Canadian Press/REX/Shutterstock

Why Subsidies?

Policy sequencing argument: subsidies serve to **build a coalition** today, and relax political opposition to carbon pricing tomorrow (Meckling et al 2015, 2017; Pahle et al 2018).

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

Goal of this paper:

1. Study this argument in a political economy framework.
2. Determine under what conditions policy sequencing is feasible,
3. and whether it can explain empirical patterns of climate policies.

This is the first paper to provide a framework to study climate policymaking with microfounded political constraints that allows policy to alter these constraints over time.

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?

My Approach

Two policies: a carbon tax and a subsidy for green investments.

Policy requires approval by a legislature.

Legislators represent constituencies that differ in how "easy to decarbonize" they are.

Polluter districts are initially a majority.

Risk of turnover: the policymaker can be replaced by an environmentally unfriendly politician in the future.

Key Tension

Distributive conflict creates a **tension**:

The proposer needs to win over pivotal polluting constituencies...

... without alienating existing green constituencies.

Why?

Subsidies help to get approval by pivotal polluting constituencies.

But they raise fiscal costs and shrink the base of pollution taxes. Green districts are eventually forced to pay for these subsidies that go to polluting districts.

Preview of Results

1. Whenever the sequencing strategy is feasible, it generates the empirical pattern:

   subsidies + low taxes initially $\rightarrow$ high taxes later.

2. Policy sequencing is feasible if and only if:

   green technologies are sufficiently advanced and investment costs are sufficiently low,

   and marginal environmental damage is neither too low nor too high.

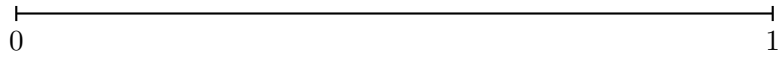
   The effect of polarization is ambiguous. Under some conditions it can help implement climate policy.

Roadmap

1. The Model
2. Results
3. Extensions
4. Empirical Implications

The Model

The Model – Economy



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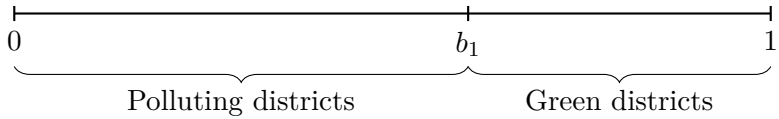

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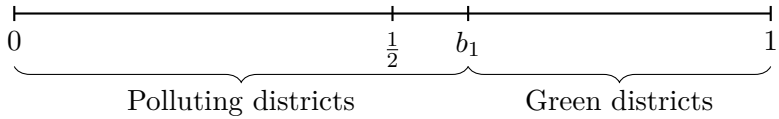

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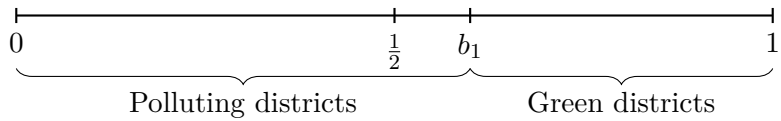
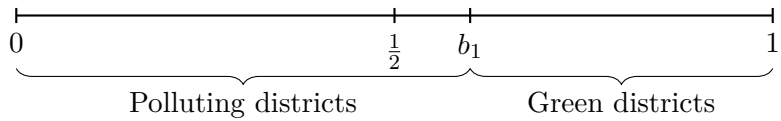


Production function is Cobb-Douglas with $\alpha = \frac{1}{2}$ using final good and capital.

- 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.

The Model – Economy



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

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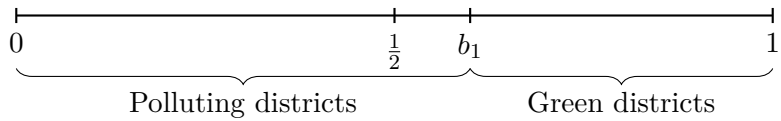

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Polluting production generates carbon emissions: producing y units $\rightarrow$ emitting y tons.

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

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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:

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

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

The Model – Policies

Income of district i:

Polluting:	$\frac{1}{2}(1-\tau_1)^2+\frac{\delta}{2}(1-\tau_2)^2+T,$
Transition:	$\frac{1}{2}(1-\tau_1)^2+s-c+\frac{\delta A}{2}i+T,$
Green:	Period-1 Income + Period-2 Income + Transfer.

The Model – Policies

Income of district i:

$$\begin{aligned}
&\text{Polluting:} && \frac{1}{2}(1-\boldsymbol{\tau_1})^2+\frac{\delta}{2}(1-\boldsymbol{\tau_2})^2+\boldsymbol{T},\\
&\text{Transition:} && \frac{1}{2}(1-\boldsymbol{\tau_1})^2+\boldsymbol{s}-c+\frac{\delta A}{2}i+\boldsymbol{T},\\
&\text{Green:} && \frac{A}{2}i+\frac{\delta A}{2}i+\boldsymbol{T}.
\end{aligned}$$

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

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

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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 **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

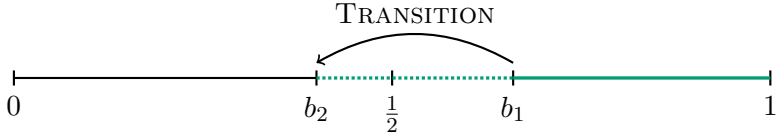
Subsidies are an **inefficient** instrument for reducing carbon emissions.

Analysis of the Full Model – Second Period

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 minority:** $b_2 \leqslant \frac{1}{2}$
   - 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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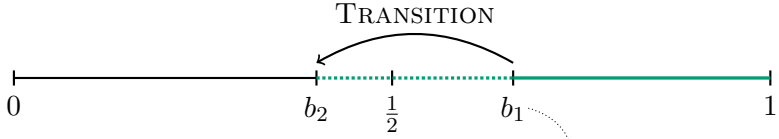

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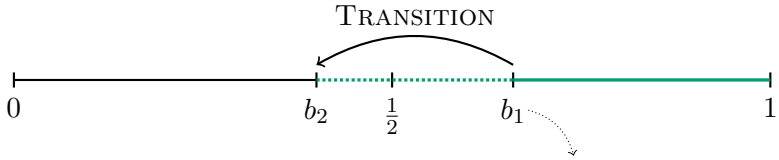

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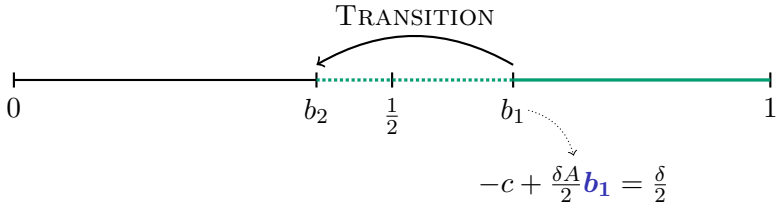

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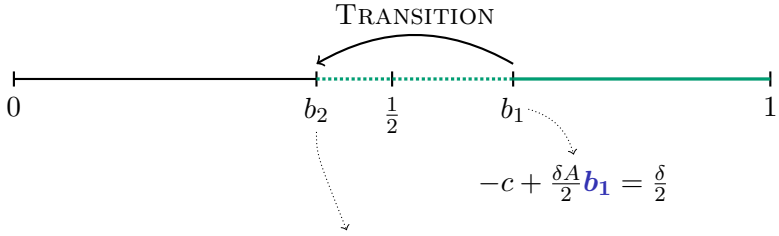
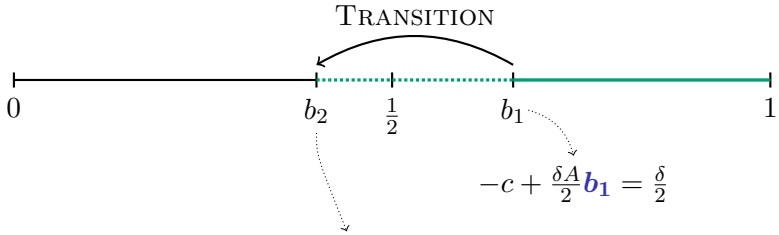


Net Benefit of Transition = Period-2 Income in Polluting Sector

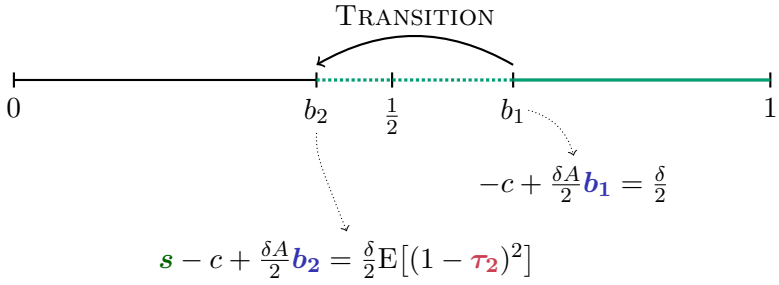
Who Transitions?



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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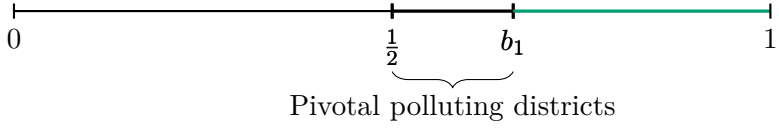

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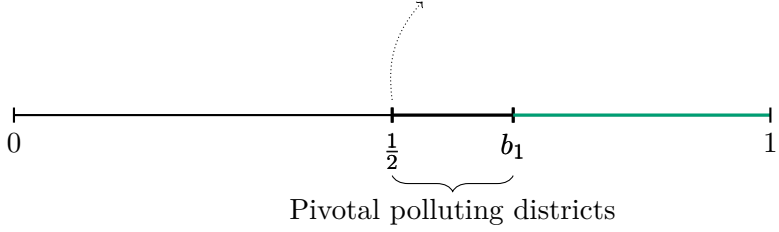
Expected Income if Policy is Implemented $\geqslant$ Exp Income If Policy is Blocked



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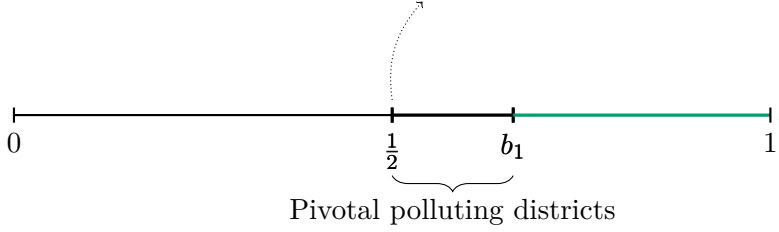
$$\frac{1}{2}(1-\tau_1)^2 + s - c + \frac{\delta A}{2}\frac{\mathbf{1}}{\mathbf{2}} + T \geqslant \frac{1}{2} + \frac{\delta}{2}$$



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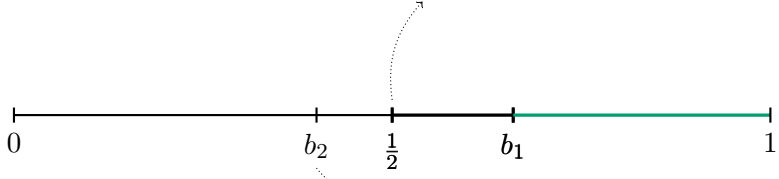

$$s - c + \frac{\delta A}{2}\boldsymbol{b_2} = \frac{\delta}{2}\mathrm{E}[(1-\tau_2)^2]$$

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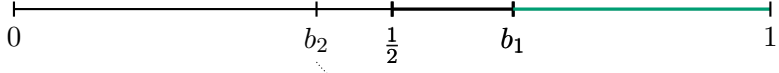
Policy is Implemented $\geqslant$ Policy is Blocked



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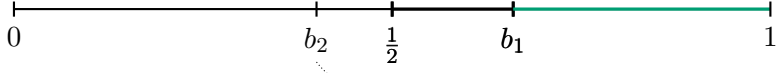
$$\frac{1}{2}(1-\tau_1)^2 + s - c + \frac{\delta A}{2}\frac{\mathbf{1}}{\mathbf{2}} + T \geqslant \frac{1}{2} + \frac{\delta}{2}$$

$$T \geqslant 0$$



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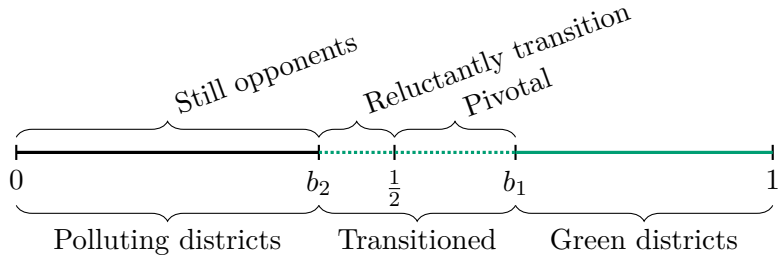
Still opponents
Reluctantly transition
Pivotal
0
b_2
$\frac{1}{2}$
b_1
1
Polluting districts
Transitioned
Green districts

Political Constraints

$$\underbrace{\frac{1}{2}(1-\tau_1)^2}_{\text{Period-1 Income}} + \underbrace{s - c + \frac{\delta A}{4}}_{\text{Net Benefit of Transition}} + \underbrace{T}_{\text{Transfer}} \geqslant \underbrace{\frac{1}{2} + \frac{\delta}{2}}_{\text{Income if Policy is Blocked}}$$

(Polluting Districts)

(Green Districts)

Political Constraints

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$$\underbrace{T}_{\text{Transfer}} = \underbrace{\qquad}_{\substack{\text{Carbon Tax Revenue}\\ \text{in Period 1}}} + \underbrace{\qquad}_{\substack{\text{Discounted}\\ \text{Carbon Tax Revenue}\\ \text{in Period 2}}} - \underbrace{\qquad}_{\substack{\text{Fiscal Cost}\\ \text{of Subsidies}}} \geqslant \underbrace{\qquad}_{\substack{\text{Transfer if}\\ \text{Policy is Blocked}}} \qquad \text{(Green Districts)}$$

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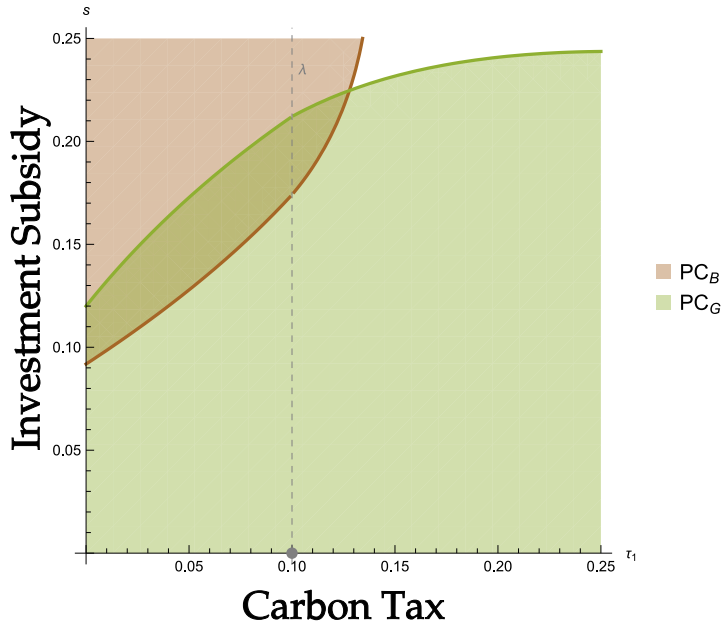
Political Constraints

Key distributive tension:

Polluting districts demand low taxes and generous subsidies.

Green districts demand high taxes if subsidies are generous.

Political Constraints



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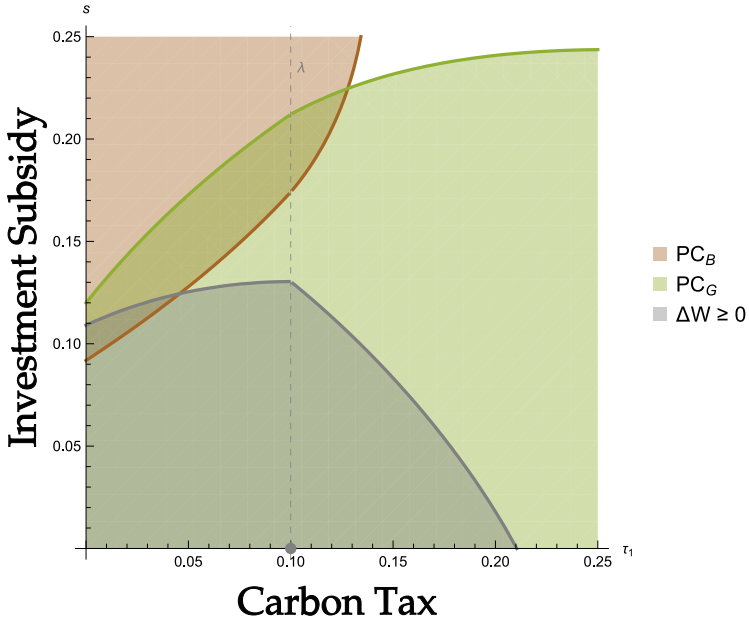

Why Are Carbon Taxes Low?

Proposition

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, i.e., $\tau_1 < \lambda$ and $s > 0$, or $\tau_1 = s = 0$.

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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, i.e., $\tau_1 < \lambda$ and $s > 0$, or $\tau_1 = s = 0$.

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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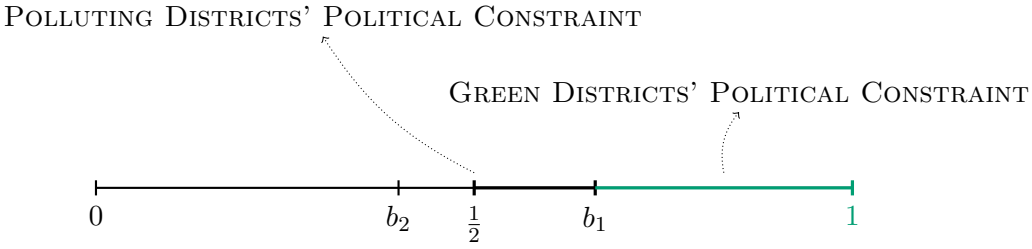

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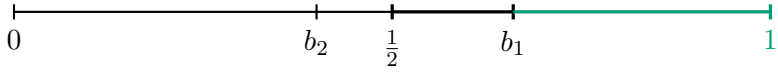
$$\frac{1}{2}(1-\tau_1)^2 + s - \boldsymbol{c} + \frac{\delta \boldsymbol{A}}{4} + T \geqslant \frac{1}{2} + \frac{\delta}{2}$$

Green Districts' Political Constraint



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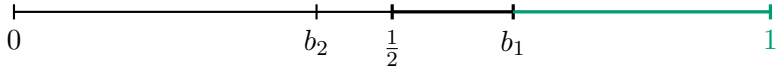
$$\frac{1}{2}(1-\tau_1)^2 + s - \boldsymbol{c} + \frac{\delta \boldsymbol{A}}{4} + T \geqslant \frac{1}{2} + \frac{\delta}{2}$$

$$\boldsymbol{b_1}\tau_1(1-\tau_1) + \delta \boldsymbol{b_2}\mathrm{E}[\tau_2(1-\tau_2)] - s(\boldsymbol{b_1} - \boldsymbol{b_2}) \geqslant 0$$



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Improving opportunities in the green sector or reducing capital costs.

- Relaxes Political Constraint by Polluting Districts.
- Tightens Political Constraint by Green Districts.

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Improving opportunities in the green sector or reducing capital costs.

- Relaxes Political Constraint by Polluting Districts.
- Tightens Political Constraint by Green Districts.

First force dominates.

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

Risk of Turnover

Increasing the probability that an opposition proposer takes power

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Increasing the probability that an opposition proposer takes power

Affects both constraints through the expected transfer T:

$$\text{Transfer} = \text{Carbon Tax Revenue} - \text{Cost of Subsidies}$$

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Increasing the probability that an opposition proposer takes power

Affects both constraints through the expected transfer T:

$$\begin{aligned}\text{Transfer} &= \text{Carbon Tax Revenue} - \text{Cost of Subsidies} \\ &= \text{Carbon Tax Base} \times \text{Carbon Tax Level} \\ &\quad - \text{Subsidy Level} \times \text{Number of Districts that Transition}\end{aligned}$$

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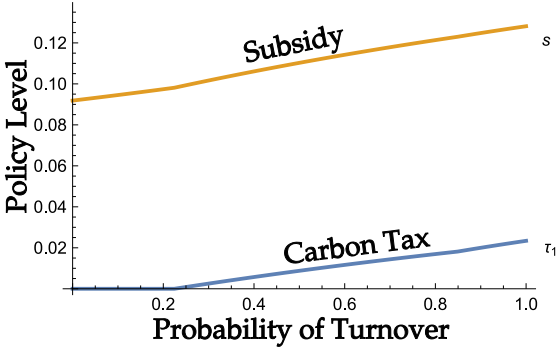
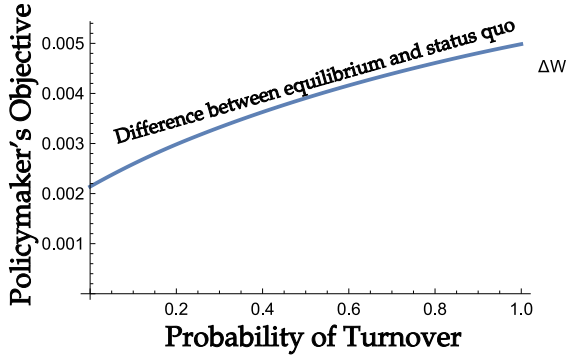
The effect is ambiguous.

Result

If b_1 is large enough, increasing the probability of turnover relaxes the constraints.

Effect of Risk of Turnover

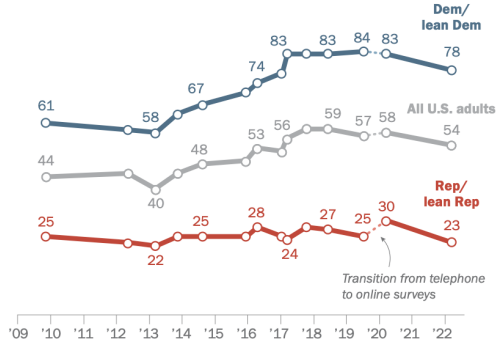




Growing polarization in the U.S.

54% of Americans view climate change as a major threat, but the partisan divide has grown

% of U.S. adults who say global climate change is a major threat to the country



Note: Respondents who gave other responses or did not give an answer are not shown.
Source: Survey conducted March 21-27, 2022.

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And yet

Biden signing the Inflation Reduction Act. Drew Angerer / Getty Images

When is the Strategy Feasible?

Increasing the social cost of carbon

Affects both constraints through the expected transfer T:

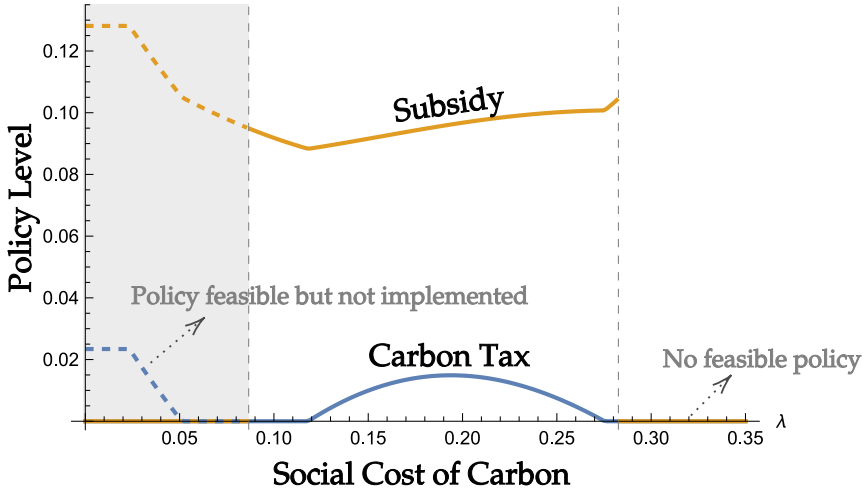
$$T = b_1\tau_1(1-\tau_1) + \delta \boldsymbol{b_2} \mathrm{E}[\boldsymbol{\tau_2(1-\tau_2)}] - s(b_1 - \boldsymbol{b_2}) \geqslant 0$$

The effect is ambiguous.

Result

If A 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 cannot be targeted.
- If we relax the perfect information assumption and adopt a mechanism design approach the optimal schedule is coarse, and the key friction persists.

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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.

Empirical Implications

Empirical Implications

Main causal claim

Subsidies $\rightarrow$ investments $\rightarrow$ preferences for climate policy $\uparrow$ $\rightarrow$ carbon pricing.

Empirical Implications

Industry level predictions

Subsidies break the "fossil fuel coalition" into three types:

"Pivotal", "Reluctant" and "Hard to abate" industries.

Exciting research agenda: study the effects of green industrial policies in real time.

IRA, EU Green Deal, South Korea's Green New Deal, Sweden's Green Industrial Leap.

Main question: do green industrial policies reduce opposition to carbon taxation?

Firm-level analysis: look at lobbying and campaign contributions.

Individual-level analysis: look at voters' preferences over time.

Empirical Implications

Country level predictions

Subsidies $\rightarrow$ investments $\rightarrow$ preferences for climate policy $\uparrow$ $\rightarrow$ carbon pricing.

Mediators: structure of the economy and political institutions.

Structural version of the model $\rightarrow$ testable predictions.

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.

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

- Taxing pollution requires green industrial policy to relax political constraints.
- Green industrial policy is affected by expectations of future pollution taxation.

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- Green industrial policy is affected by expectations of future pollution taxation.

Policy implications:

- *Some* inefficient policies are good because of their policy feedback effects.