Inefficient Policies in the Green Transition

Juan Dodyk

Harvard

Two Stylized Empirical Phenomena

- Many different policy instruments are used to reduce carbon emissions.
  - Prevalent policies are significantly less efficient than best policies (Mealy et al 2024).

Two Stylized Empirical Phenomena

- Many different policy instruments are used to reduce carbon emissions.
  - Prevalent policies are significantly less efficient than best policies (Mealy et al 2024).
- Policy sequences: inefficient policies followed by more efficient ones.
  - Subsidies first, carbon pricing later (Linsenmeier et al, 2022).

Two Stylized Empirical Phenomena

- Many different policy instruments are used to reduce carbon emissions.
  - Prevalent policies are significantly less efficient than best policies (Mealy et al 2024).
- Policy sequences: inefficient policies followed by more efficient ones.
  - Subsidies first, carbon pricing later (Linsenmeier et al, 2022).

Examples:

- Germany: Feed-in Tariff in 2000 → expansion in the coverage of the EU ETS in 2021.
- EU: Renewable Energy Directive in 2001 + ETS in 2003 with low carbon price → prices above 80€ per ton since 2022.
- Canada: inefficient regulations during the 2000s → national carbon price in 2018.
- US: Inflation Reduction Act of 2022 → carbon pricing in the future?

Argument

Meckling et al (2015, 2017):

- Efficient policies impose costs on polluters → not feasible if polluters are politically powerful.
- Subsidies that induce investments in green capital can reduce opposition in pivotal constituencies today.
- These investments change preferences in the future, making carbon pricing feasible.

Argument

Meckling et al (2015, 2017):

- Efficient policies impose costs on polluters → not feasible if polluters are politically powerful.
- Subsidies that induce investments in green capital can reduce opposition in pivotal constituencies today.
- These investments change preferences in the future, making carbon pricing feasible.

Theoretical questions:

- Under what conditions is this strategy feasible?
- How is this affected by polarization?

This Paper

Dynamic model of climate policymaking.

- Two instruments: carbon tax and a green investment subsidy.
- Policy requires approval by a legislature.
- Legislators represent constituencies that differ in how much they are impacted by decarbonization.
- The policymaker cannot commit, and can change in the future.

The Model – Economy

Districts $i \in [0, 1]$.

Invested in either green or brown sector: $\chi_i = 1$ if brown, $\chi_i = 0$ if green.

- Initially $[0, b_1]$ are brown, $(b_1, 1]$ green, with $b_1 > \frac{1}{2}$.
- Brown district i can invest in green capital and transition at cost $c \geqslant 0$.

One good in the economy besides capital.

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

- Brown district uses $\frac{1}{2}y^2$ units to produce y.
- Green district i uses $\frac{1}{2}y^2$ units to produce Aiy.
  - Consumption: $y - \frac{1}{2Ai}y^2$.
- $A > 1$ measures the productivity of green technology.

Brown production leads to carbon emissions: producing y units $\rightarrow$ emitting y tons.

The Model – Policies

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

- Brown districts pay τy, so their income is $\frac{1}{2}(1-\tau)^2$.
- Green districts are not affected, and their income is $\frac{1}{2}Ai$.

Investment subsidy $s \geqslant 0$.

Lump-sum transfer T.

The Model – Politics

The districts are represented in a legislature.

Initially no climate policy, and the proposer is G.

In each period $t = 1, 2$:

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

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

The Model – Preferences

Agents maximize discounted expected utility with discount factor δ.

Legislators only care about consumption π_{it}.

Agenda-setter P's payoff in period t is

$$W_P = \int_0^1 \pi_{it}\, di - 1_{P=G}\lambda \underbrace{\int_0^1 \chi_{it} y_{it}\, di}_{\text{emissions}}.$$

λ is the social cost of carbon.

Benchmark – Unconstrained Proposer

If the proposer decides policy in both periods,

- **carbon tax equals the social cost of carbon**: $\tau_1 = \tau_2 = \lambda$,
- investment subsidy not used: $s = 0$. It's an **inefficient instrument** for reducing emissions.

Benchmark – Unconstrained Proposer

If the proposer decides policy in both periods,

- **carbon tax equals the social cost of carbon**: $\tau_1 = \tau_2 = \lambda$,
- investment subsidy not used: $s = 0$. It's an **inefficient instrument** for reducing emissions.

With probability ρ of replacement:

- carbon tax is still equal to the social cost of carbon,
- **positive optimal subsidy**: $s = \delta\rho\lambda$.

Benchmark – Unconstrained Proposer

If the proposer decides policy in both periods,

- **carbon tax equals the social cost of carbon**: $\tau_1 = \tau_2 = \lambda$,
- investment subsidy not used: $s = 0$. It's an **inefficient instrument** for reducing emissions.

With probability ρ of replacement:

- carbon tax is still equal to the social cost of carbon,
- **positive optimal subsidy**: $s = \delta\rho\lambda$.

Turnover explains the use of subsidies, but not the sequencing.

Legislative Bargaining

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

- Strategy: use the subsidy to induce the pivotal districts $[\frac{1}{2}, b_1]$ to accept policy today and transition.
- In the second period there is a green majority, so a green policymaker can implement an optimal carbon tax.

Legislative Bargaining

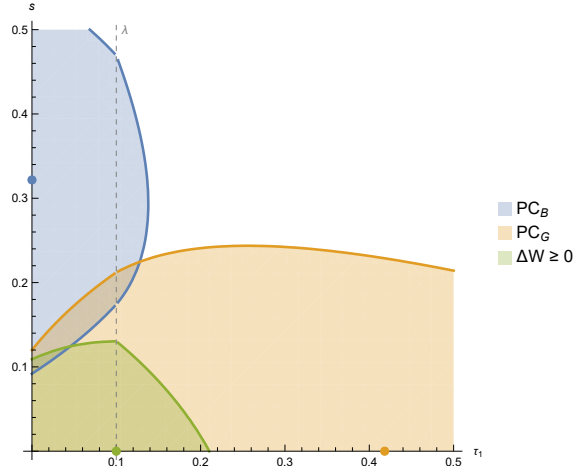
Brown districts are a majority, so a **winning coalition** must include some of them.

- Strategy: use the subsidy to induce the pivotal districts $[\frac{1}{2}, b_1]$ to accept policy today and transition.
- In the second period there is a green majority, so a green policymaker can implement an optimal carbon tax.

The need to build a coalition imposes two **political constraints**:

- Brown districts demand subsidies as compensation for the costs of transition.
- Green districts demand intertemporal budget balance.

Political Constraints



Results

Key trade-offs:

- Imposing costs on polluters today requires more subsidies to provide compensation: $\tau_1 \uparrow \Rightarrow s \uparrow$.
- Subsidies create a fiscal cost, which can alienate green members of the coalition.

Results

Key trade-offs:

- Imposing costs on polluters today requires more subsidies to provide compensation: $\tau_1 \uparrow \Rightarrow s \uparrow$.
- Subsidies create a fiscal cost, which can alienate green members of the coalition.

Proposition. *In equilibrium either* $\tau_1 = s = 0$ *or* $\tau_1 < \lambda$ *and* $s > 0$.

Results

Key trade-offs:

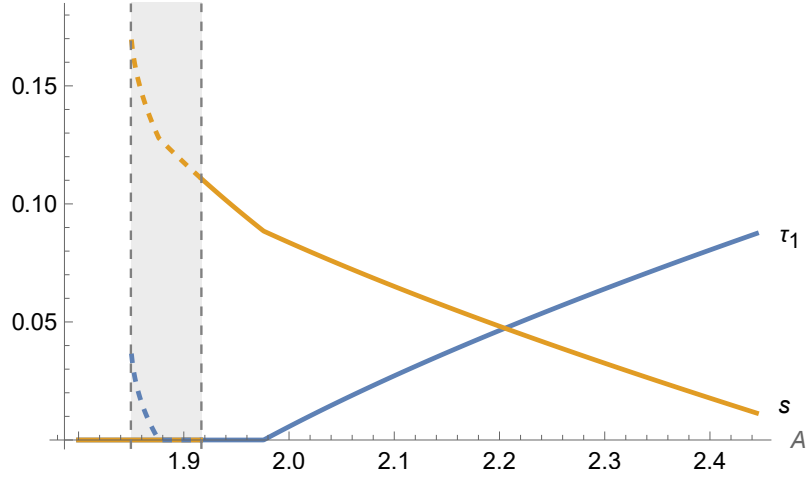
- Imposing costs on polluters today requires more subsidies to provide compensation: $\tau_1 \uparrow \Rightarrow s \uparrow$.
- Subsidies create a fiscal cost, which can alienate green members of the coalition.

Proposition. *In equilibrium either* $\tau_1 = s = 0$ *or* $\tau_1 < \lambda$ *and* $s > 0$.

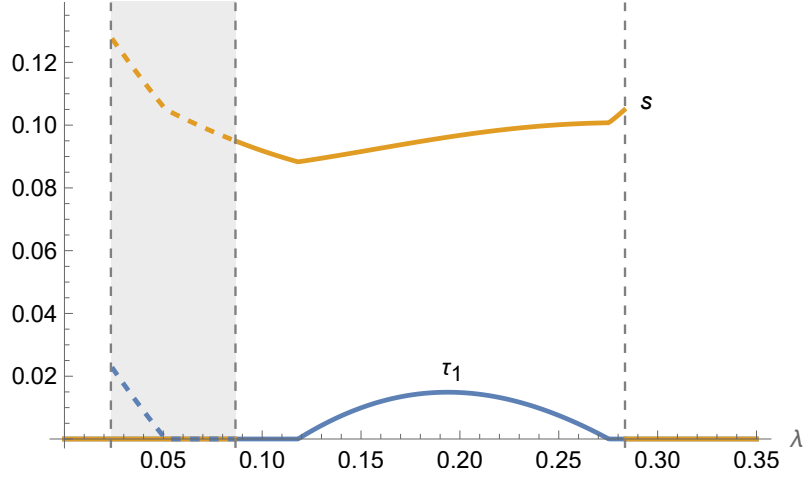
Why?

- The subsidy is necessary to get support from brown districts.
- An optimal carbon tax in the first period requires a large subsidy – a small reduction has a second-order effect on welfare, but allows the proposer to reduce the subsidy, which has a first-order positive effect.

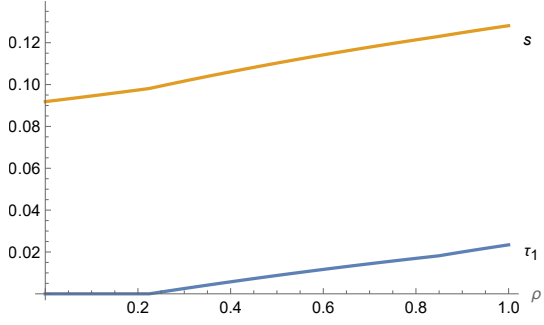
Equilibrium Policies

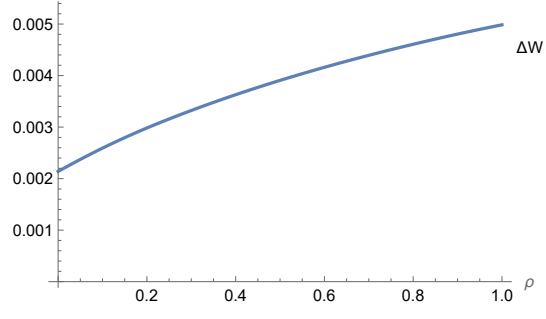


Equilibrium Policies



Political Turnover





Soft Commitments

There are two equilibria if initial political opposition is not too strong.

- If the initial policy proposal fails, but agents expect that a green proposer will implement an optimal carbon tax in the second period, some will invest in green capital.
- If enough invest, in the second period green districts form a majority, and the expectation is fulfilled.

Soft Commitments

There are two equilibria if initial political opposition is not too strong.

- If the initial policy proposal fails, but agents expect that a green proposer will implement an optimal carbon tax in the second period, some will invest in green capital.
- If enough invest, in the second period green districts form a majority, and the expectation is fulfilled.

The condition is

$$b_1 \leqslant \frac{1}{2} + \frac{(1-\rho)\lambda(2-\lambda)}{A}.$$

In this equilibrium the proposer has more bargaining power, and can implement more ambitious policies.

Soft Commitments

There are two equilibria if initial political opposition is not too strong.

- If the initial policy proposal fails, but agents expect that a green proposer will implement an optimal carbon tax in the second period, some will invest in green capital.
- If enough invest, in the second period green districts form a majority, and the expectation is fulfilled.

The condition is

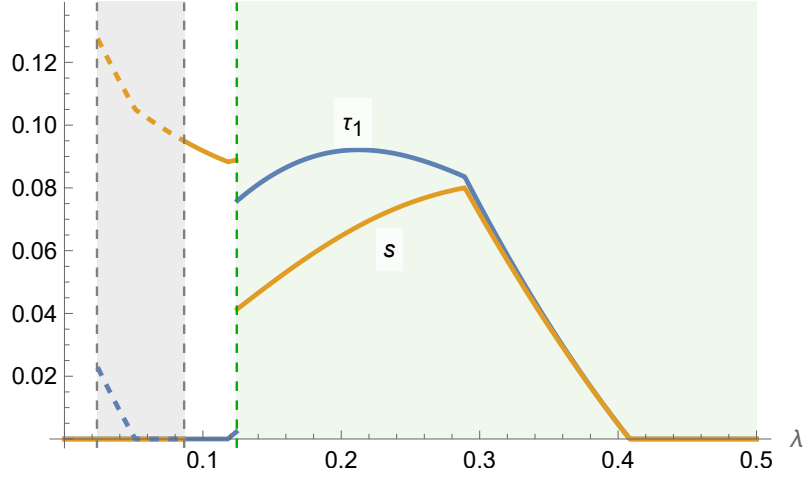
$$b_1 \leqslant \frac{1}{2} + \frac{(1-\rho)\lambda(2-\lambda)}{A}.$$

In this equilibrium the proposer has more bargaining power, and can implement more ambitious policies.

Rationale for soft commitments such as net-zero targets or NDCs.

- But this logic only works under some conditions, and equilibrium policies are still not first-best.

Equilibrium Policies



Conclusion

Dynamic model of climate policy:

- Analysis of the political logic of green industrial policy.
- Conceptual takeaways: there are trade-offs, and political feasibility is not guaranteed.
- Counter-intuitive results:
  - The ambition of policymakers can make the political constraints harder to satisfy.
  - Polarization can help start the policy sequence.
- The model provides a rationale for the use of soft commitments:
  - They can work by shifting expectations to a better equilibrium.
  - This only works if initial political opposition is not too strong and policymakers are sufficiently concerned about climate.

Manuscript in my webpage: `juandodyk.github.io`