Strategic Commitments to Decarbonize:

The Role of Large Firms, Common Ownership, and Governments

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The economics of NZ commitments

Since Paris 2015: Rise of firm and government commitments to “Net Zero” targets.

Why?

- Cheap talk/greenwashing
- ESG preferences of stakeholders (investors, customers, managers, workers...)

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Our paper: **Could there be something else?**

1. Can commitments affect transition paths of emissions and GDP?
2. What drives firm commitments? Which firms have incentives to commit?
3. How do firm commitments and government policies interact?

BlackRock/Larry Fink's 2022 letter to CEOs

"**We focus on sustainability not because we're environmentalists, but because we are capitalists** and fiduciaries to our clients. As part of that focus, we are asking companies to set short-, medium-, and long-term targets for greenhouse gas reductions. These targets, and the quality of plans to meet them, are critical to the long-term economic interests of your shareholders."

This paper

Backbone: Climate transition with **dual externality** (Acemoglu et al., 2012)

- environmental + technological (green innovation/adoption of green tech)
- requires two Pigouvian policies: carbon taxes and green subsidies
- potentially constrained by (unmodeled) budget/observability/politics

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\+ **Strategic interactions** between multiple actors:

- current government
- future government (i.e., limited commitment)
- large firms/large investors
- other firms

Main results

Evidence: **large firms/common ownership $\rightarrow$ more and earlier NZ commitments**

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- bright side of common ownership: internalize technological spillovers
- good substitutes for green subsidies but not for carbon taxes
- even if committers are purely profit-maximizing

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Government commitments: **promises of future carbon taxes**

- high future carbon tax incentivizes transition, but time-inconsistent
- firm commitments improve govt credibility to tax carbon

Literature

Transition to green technology: Acemoglu et al. (2012, 2016), Aghion et al. (2016), ...

Government (lack of) commitment:

- **Climate**: Besley-Persson (2023), Acemoglu-Rafey (2023), Biais-Landier (2023), ...
- **Financial regulation**: Acharya-Yorulmazer (2007), Farhi-Tirole (2012), ...

Firm commitments: Bolton-Kacperczyck (2023), Ramadorai-Zeni (2023), Sastry et al. (2024)

Common ownership:

- **Externalities and antitrust (law)**: Condon (2020), Miazad (2023)
- **Innovation**: Lopez and Vives (2019), Anton et al. (2021), Aghion et al. (2013)
- **Climate**: Azar et al. (2021), Ilhan et al. (2023)

Motivating evidence: Data

- Compustat + Holdings data from SEC 13F filings (Backus et al. 2021)
  $\rightarrow$ 3,560 firms
- NZ commitments: Science Based Targets initiative (SBTi) and Net Zero Tracker
  $\rightarrow$ 9% of firms have made a NZ commitment (2016-2023)
- Decarbonization investments (DI) from CDP
  $\rightarrow$ 19% of firms have reported a decarbonization investment (2016-2023)
- Green Common Ownership: 13F investors belonging to NZ investor alliance
  $\rightarrow$ Climate Action 100+, NZ Asset Managers, UN NZ Alliance

Large Firms: NZ commitments

	NZ		
	(1)	(2)	(3)
Log(Assets)	0.508***	0.572***	
	(0.055)	(0.044)	
Rank(Assets)			1.192***
			(0.092)
Constant	0.074***	0.072***	-0.122***
	(0.018)	(0.001)	(0.016)
IndustryFE	No	Yes	Yes
Observations	3,560	3,560	3,560
Adj R^2	0.158	0.190	0.174

Large Firms: Decarbonization investments

	DI		
	(1)	(2)	(3)
Log(Assets)	0.859***	1.009***	
	(0.104)	(0.060)	
Rank(Assets)			2.193***
			(0.149)
Constant	0.163***	0.159***	-0.200***
	(0.039)	(0.002)	(0.027)
IndustryFE	No	Yes	Yes
Observations	3,560	3,560	3,560
Adj R^2	0.241	0.325	0.321

Green Common Ownership

	NZ		DI	
	(1)	(2)	(3)	(4)
NZ Investor Ownership	1.550***	1.590***	1.022***	1.043***
	(0.259)	(0.234)	(0.177)	(0.153)
Constant	0.023***	0.021*	0.146***	0.145***
	(0.005)	(0.010)	(0.027)	(0.007)
IndustryFE	No	Yes	No	Yes
Observations	3,560	3,560	3,560	3,560
Adj R^2	0.330	0.355	0.076	0.122

Firm Size and Green Common Ownership: NZ

	NZ		
	(1)	(2)	(3)
NZ Investor Ownership	1.343***	1.374***	1.392***
	(0.246)	(0.226)	(0.218)
Log(Assets)	0.303***	0.361***	
	(0.040)	(0.040)	
Rank(Assets)			0.719***
			(0.065)
Constant	0.022*	0.019*	-0.099***
	(0.010)	(0.009)	(0.013)
IndustryFE	No	Yes	Yes
Observations	3,560	3,560	3,560
Adj R^2	0.380	0.416	0.406

Firm Size and Green Common Ownership: DI

	DI		
	(1)	(2)	(3)
NZ Investor Ownership	0.486***	0.485***	0.483***
	(0.127)	(0.097)	(0.101)
Log(Assets)	0.784***	0.935***	
	(0.108)	(0.059)	
Rank(Assets)			2.029***
			(0.157)
Constant	0.145***	0.140***	-0.192***
	(0.040)	(0.004)	(0.027)
IndustryFE	No	Yes	Yes
Observations	3,560	3,560	3,560
Adj R^2	0.256	0.340	0.336

Effect on Emission Intensity

	Emissions/Assets Reduction		
	(1)	(2)	(3)
NZ(1/0)	0.035***		0.030**
	(0.010)		(0.011)
DI(1/0)		0.079**	0.073**
		(0.027)	(0.028)
Constant	0.887***	0.828***	0.822***
	(0.003)	(0.025)	(0.025)
Industry FE	Yes	Yes	Yes
Observations	1,595	1,595	1,595
R^2	0.07	0.07	0.07

Model

Can commitments spur the climate transition?

Setup: Production and emissions

- **Production**

$$k_i \to f(k_i)$$

- **Emissions**

$$e_i = \overbrace{\theta_i}^{\text{emission intensity}} \times k_i$$

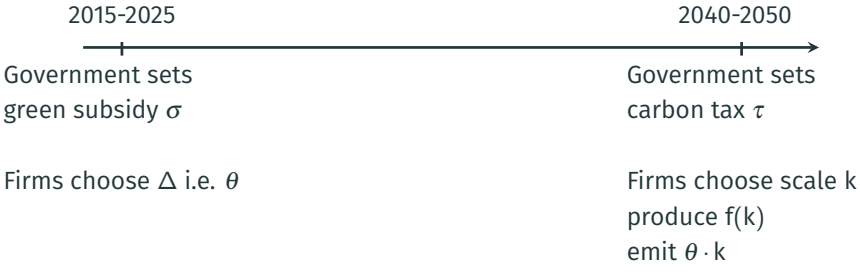
$\to$ environmental damages $\mathscr{L}(E)$ from aggregate emissions $E = \int_i e_i di$

- **Green technology** Δ (renewables, carbon capture, ...) reduces emission intensity

$$\theta_i = \theta_0 - \Delta_i - \chi\bar{\Delta}$$

at individual cost $C(\Delta_i)$
  - isomorphic to externality $\chi\bar{\Delta}$ reducing cost C
  - more general model: χ_{ij} capturing spillovers network

Basic model



with functional forms:

- Quadratic technology: $f(k) = (1+a)k - k^2/2$, $C(\Delta) = c \cdot \Delta^2/2$
- Linear damages: $\mathscr{L}(E) = \gamma \cdot E$ where $\gamma =$ social cost of carbon (SCC)
  [extension: convex damages]

Welfare and First Best

Welfare: net production minus damages $W = \int_i [f(k_i) - k_i - C(\Delta_i)]\,di - \gamma E$

Proposition

(k^{FB}, Δ^{FB}) can be implemented with **<u>two</u> Pigouvian instruments**

$$\text{firm profits} = f(k) - k - C(\Delta) - \underbrace{\tau^{FB}}_{\text{carbon tax}} \times e + \underbrace{\sigma^{FB}}_{\text{green subsidy}} \times \Delta$$

$\tau^{FB} = \gamma$ — lower production and emissions

$\sigma^{FB} = \chi \cdot \gamma \cdot k^{FB}$ — lower emissions w/o excessive output cost

$\rightarrow$ Joint policy is **time-consistent**: firm/government commitments not needed.

Policies and constraints

Examples:

- τ: EU Emissions Trading System
- σ: US Inflation Reduction Act tax credits for renewables, CCS, EVs

Next: **Constraints** arising from budget/observability/politics

$$\tau \leq \bar{\tau} \quad (\sim \text{US?})$$
$$\sigma \leq \bar{\sigma} \quad (\sim \text{Europe?})$$

give a role to firm and government commitments.

Firm Commitments

Firm commitments in the model

Firm commitments = a “subset of firms” of mass μ sets Δ...

- coordinated (e.g., common Net-Zero targets)
- publicly, before other firms invest (i.e., as Stackelberg leader)

$\rightarrow$ **Large firms**, or firms **commonly owned by large institutional investors**

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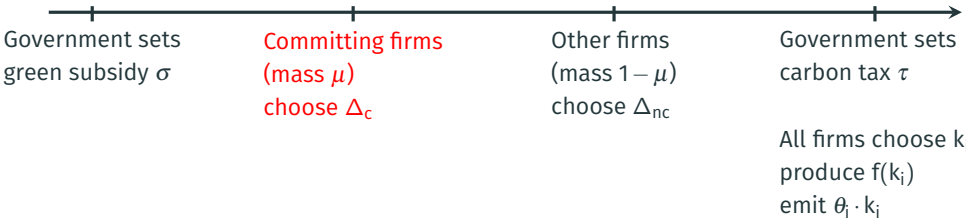

Firm Commitments

Non-Committing and Committing firms maximize different objectives:

$$\text{NC:} \quad f(k_{nc}) - k_{nc} - C(\Delta_{nc}) - \tau\Big[\theta_0 - \Delta_{nc} - \underbrace{\chi\left(\mu\Delta_c + (1-\mu)\tilde{\Delta}_{nc}\right)}_{\text{taken as given}}\Big]k_{nc} + \sigma\Delta_{nc}$$

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$$\text{C:} \quad f(k_c) - k_c - C(\Delta_c) - \tau\Big[\theta_0 - \Delta_c - \chi\left(\mu\Delta_c + (1-\mu)\Delta_{nc}(\Delta_c)\right)\Big]k_c + \sigma\Delta_c$$

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Firms purely profit-maximizing: **do not care directly about damages**

$\rightarrow$ only technological externality enters firm profits
internalizing it lowers carbon tax bill for committers (and other firms)

Firm Commitments and Welfare

Proposition

1. Suppose that $\bar{\tau} \geq \gamma$ but $\bar{\sigma} < \sigma^{FB}$ ($\sim$ EU)
   Welfare is below W^{FB}, **increases with μ**, converges to W^{FB} as $\mu \to 1$.

Firm Commitments and Welfare

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2. Suppose that $\bar{\sigma} \geq \sigma^{FB}$ but $\bar{\tau} < \gamma$ ($\sim$ US)
   Welfare is below W^{FB} but **FC cannot improve welfare** relative to no FC ($\mu = 0$).
   FC can even decrease welfare due to misallocation of green technology.

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   Welfare is below W^{FB} but **FC cannot improve welfare** relative to no FC ($\mu = 0$).
   FC can even decrease welfare due to misallocation of green technology.

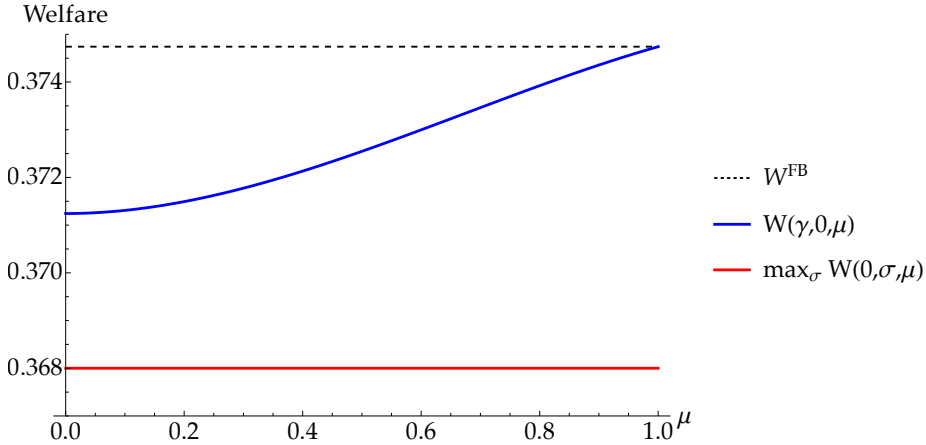
$\to$ FC substitutes for missing green subsidies, but **carbon tax remains essential**

$$\frac{\partial^2 \Delta}{\partial \mu \partial \tau} > 0$$

"Bright side of common ownership", but **not** about investors becoming benevolent.

Firm Commitments $\rightarrow$ Welfare

$W(\tau, \sigma, \mu) \equiv$ welfare under policies (τ, σ) and FC of size μ



Government Commitments

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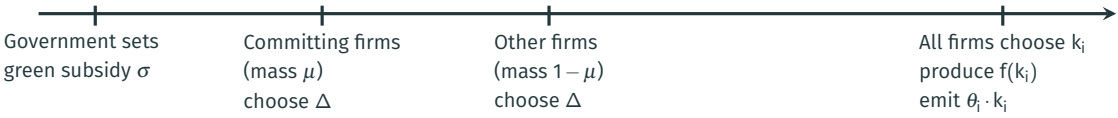


Government Commitments

Proposition

Suppose $\bar{\sigma} < \sigma^{FB}$ but $\bar{\tau} \geq \gamma(1+\chi)$ and no FC: $\mu = 0$.

It is optimal to promise a carbon tax τ^c with

$$\gamma < \tau^c < \gamma(1+\chi)$$

- First best: Subsidies σ avoid excessive carbon taxes harming production.
- Second best: **Threaten high future carbon taxes** $\tau^c > \gamma$ to spur green innovation.

Kaenzig (2023): Carbon price shocks → green patents

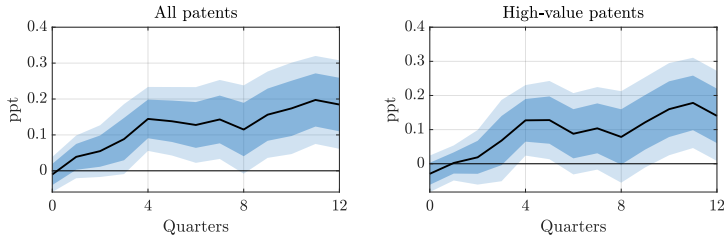
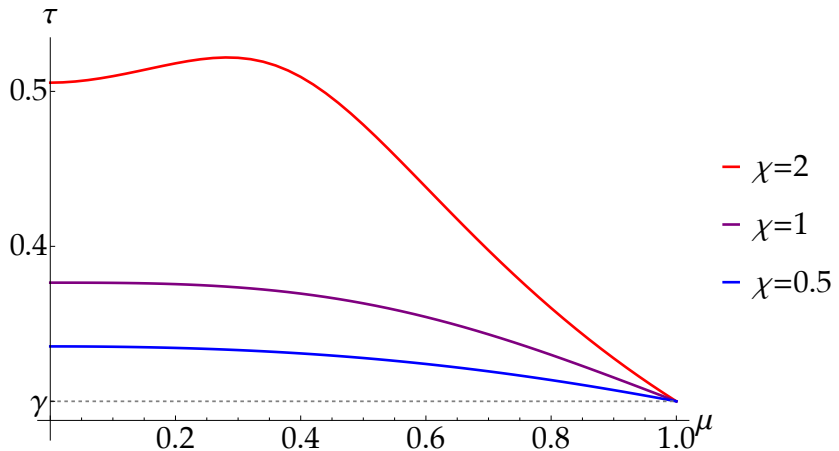


Figure 11: Patenting in Climate Change Mitigation Technologies

See also Calel-Dechezlepretre (2016): EU ETS ↑ green innovation.

Optimal Government Commitments (+ FC)



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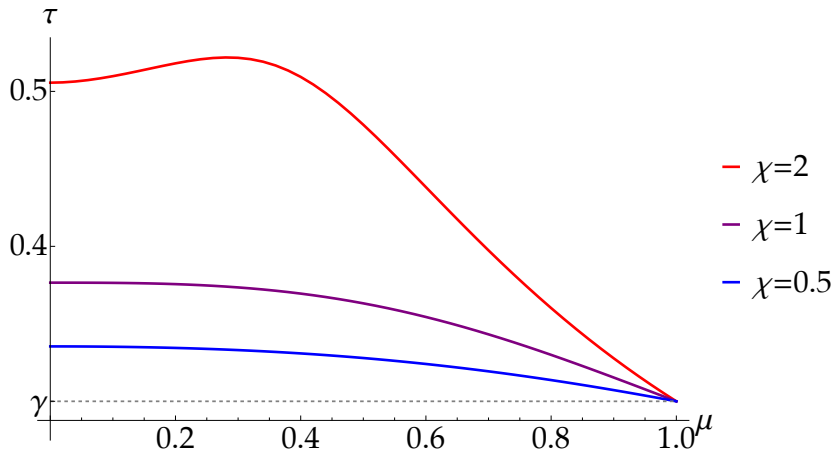
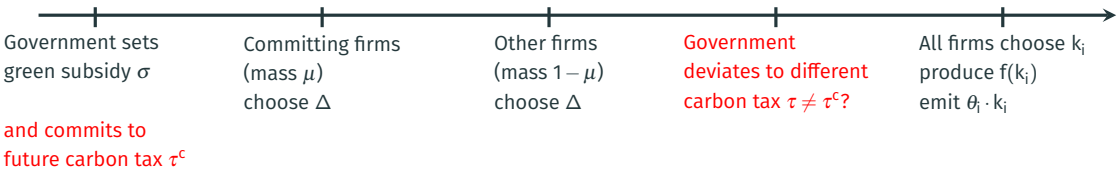


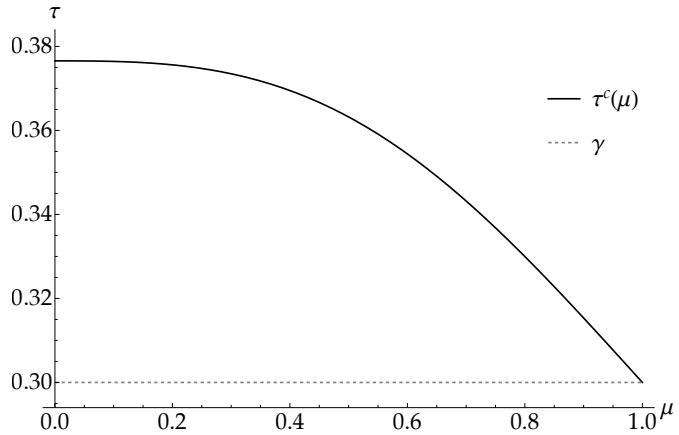
Problem: **time-inconsistency**. Ex post, govt tempted to lower carbon tax to $\tau = \gamma$

The Time-Inconsistency Problem



Focus on constrained subsidies $\bar{\sigma} = 0$, which is when commitments are useful.

Optimal Credible Government Commitment



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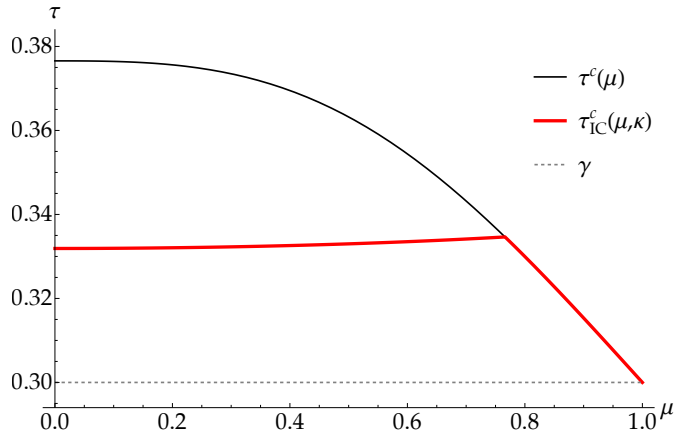

1. Any given carbon tax τ is **less costly** when $\mu \uparrow \Rightarrow$ enforcement more credible
2. **Lower τ required** to incentivize green tech, when $\mu \uparrow \Rightarrow$ even more credible

Conclusion

Firm commitments

- Commitments by profit-maximizing firms/investors reduce carbon tax bill
- Imperfect substitutes for green tech subsidies
- More useful in EU than in US?

Government commitments

- Promise high future carbon tax to incentivize transition
- Time-inconsistency problem
- Firm commitments improve government credibility