Environmental Policy and Corporate Social Responsibility

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Introduction

- Corporate Social Responsibility (CSR) refers to a company's commitment to operate in an ethical, sustainable, and socially conscious manner.
- Firms' intrinsic motivations differ widely.
  - Some adopt CSR for purely strategic reasons, caring about emissions only insofar as they affect demand and profits.
  - Others, particularly mission-oriented firms such as La Poste Groupe, take a broader view that incorporates wider stakeholder concerns and internalize environmental externalities in their decision-making.
- Understanding how such heterogeneous motivations interact with competition and environmental regulation is crucial for policy design.

- Mains questions:
  - Is CSR always welfare improving?
  - Can it replace regulation?
  - If not how to design policy.
- Build on Borsenberger et al. (2025):
  - firms differ in their degree of CSR and compete in a Cournot market.
  - shows that CSR may backfire—reducing welfare and potentially driving the fully committed firm out of the market.
- This answers two of the three question; here we address the third one: policy design.

- We consider two instruments:
  - emissions tax τ_i.
  - output subsidy s_i.
- Can be uniform or targeted and possibly budget balanced.
- A major departure from Borsenberger et al. (2025) is that we introduce a fixed cost along with a break-even constraint for the altruistic firm.
- Introduces a potential conflict between responsibility and profitability.
- Consequently, optimal environmental policy must jointly address externalities, market power, and the sustainability of mission-oriented firms.

Model

Demand

- Two differentiated products, x_1 and x_2: preferences are given by

$$u(x_1, x_2) - p_1 x_1 - p_2 x_2 - \sigma x_1 e_1 - \sigma x_2 e_2,$$

  where e_i is level of emissions per unit of output.

- Demand functions $x_1(q_1, q_2)$ and $x_2(q_1, q_2)$, with

$$q_i = p_i + \sigma e_i,$$

  where p_i is the producer price and q_i "full" price.

Cost

- Two firms, each producing one of the goods with cost functions

$$C_i(x_i, e_i) = c_i(x_i) - \gamma_i(e_i)x_i + F_i$$

  where $c_i'(x_i) > 0$, $c''(x_i) > 0$, $\gamma_i''(e_i) < 0$ and $\gamma_i'(e_i) > 0$, for $e_i < \bar{e}_i$ and $\gamma_i'(e_i) = 0$, for $e_i \geq \bar{e}_i$.

- In words, marginal costs are increasing (in quantity) and cost decreases with e_i up to $\bar{e}_i$, so that producing in a less polluting way is more costly.

- Total emissions given $E = x_1e_1 + x_2e_2$ imply social cost of $\psi(E)$

First best

The FOCs are:

$$\gamma_i'(e_i^*) = \psi'\left(E^*\right)$$
$$q_i^* = c_i'(x^*) - \gamma_i(e^*) + e_i^*\psi'(E^*)$$

Duopoly scenarios

Both firms are strategic

- A b-CSR (strategic) firm maximizes π_i:

$$\max_{x_i, e_i} \quad \pi_i = p_i(x_1, x_2, e_i)x_i - c(x_i) + \gamma(e_i)x_i - \tau_i x_i e_i + s_i x_i - F_i.$$

  which yields

$$\gamma'(e_i) = \sigma + \tau_i$$

- Best-reply functions: $x_1 = f_1(x_2, e_2)$, $x_2 = f_2(x_1, e_1)$, $e_1 = g_1(x_2, e_2)$ and $e_2 = g_2(x_1, e_1)$

- Note that $e_i = \widetilde{e}_i(\tau_i)$ is constant and does not depend on that emissions of the other firm.

- Consequently we return to a standard Cournot game where the cost is given by $c(x_i) - \gamma_i(\widetilde{e}_i(\tau_i))x_i + \tau_i x_i \widetilde{e}_i(\tau_i)$.

Mixed duopoly: b-CSR and w-CSR

- Assume that firm 1 is b-CSR so that its objective and thus it's best-reply functions are the same as in the previous scenario.
- Firm 2 is now w-CSR and maximizes

$$\max_{x_2,e_2} WE = u\left(x_1, x_2\right) - c(x_2) + \gamma(e_2)x_2 - \psi\left(x_1 e_1 + x_2 e_2\right)$$
$$\text{s.t. } \pi_2 = p_2(x_1, x_2, e_2)x_2 - c(x_2) + \gamma(e_2)x_2 - \tau_2 x_2 e_2 + s_2 x_2 - F_2 \geq 0.$$

- When the break-even constraint is not binding ($\lambda = 0$), we have

$$p_2 = c'(x_2) - \gamma(e_2) + e_2[\psi' - \sigma].$$

- The price is equal to the private marginal cost plus the environmental cost that is not taken into account by consumers.
- So implicitly the firm imposes a Pigouvian tax on itself.

- When $F = 0$ and $\tau_2 = s_2 = 0$, the firm always makes a positive profit.
- But when $F > 0$ or $\tau_2 > 0$ constraint may become binding (and we have extra term)
- The level of e_2 is now determined by a modified emissions rule:

$$\gamma'(e_2) + \lambda [\gamma'(e_2) - \tau_2 - \sigma] = \psi' (x_1 e_1 + x_2 e_2) .$$

- When $\lambda = 0$: standard rule.
- Otherwise emissions may differ from optimal level.
- When $\tau_2 = \psi' - \sigma$ and ψ' is constant we have $e_2 = e_2^*$, but when $\tau_2 < \psi' - \sigma$, $e_2 > e_2^*$. The firm increases emissions to be able to break even.

Illustrations

- Quadratic utilities (based on Singh and Vives) so that demands are linear and we choose parameters so that goods are substitutes; ψ is linear (constant cost of ton of carbon emissions).
- Cost
$$C(x_i, e_i) = kx_i + \mu x_i (e_i - \bar{e}_i)^2 ,$$
- Set $F_1 = F_2$ so that firm 2's profits are zero in the laissez-faire (no policy).

Laissez-faire

	x_1	x_2	e_1	e_2	π_1	π_2	E	W
FB	16.04	16.04	4.5	4.5			144.37	184.27
$b-CSR$	10.45	10.45	4.9	4.9	47.13	47.13	102.49	143.53
$w-CSR$	9.77	17.29	4.9	4.5	33.29	0	125.72	163.86

Uniform policies

- Uniform emissions tax
  - per-unit emissions of w-CSR firm increase,
  - but overall negative effect on output dominates so that both global emissions and welfare decrease with τ.
- Uniform output subsidy
  - no change in per-unit emissions,
  - total emissions increase (along with output),
  - but output effect is dominant for welfare which increases.

Targeted policies

- Emissions tax on firm 1 ($\tau_2 = s_1 = s_2 = 0$)
  - welfare is larger than with uniform policy but smaller than in LF; once again output effect dominates,
  - but small targeted tax combined with large uniform output subsidy increases welfare; subsidy mitigates output effect.
- Subsidy on firm 2: no impact.

Budget-balanced policies

- Set s or τ and adjust the other variable so that tax revenues equal expenditures in equilibrium
  - subsidy mitigates output effect and total welfare increases.

Impact of fixed cost

- Consider a larger level of F such that $\lambda > 0$ in the LF.
- Then output subsidy on s_2 is welfare increasing
  - increases output,
  - allows firm 2 to reduce its per-unit emissions.

Conclusion

- **CSR is not enough:** Even welfare-oriented (w-CSR) firms deviate from the Pigouvian outcome when financial (break-even) constraints bind.
- **Core mechanism:** Financial viability can force CSR firms to **increase emissions above the social optimum** to survive.
- **Policy trade-offs:** Standard instruments perform differently under imperfect competition:
  - Emissions taxes $\downarrow$ emissions but can $\downarrow$ welfare (output distortion)
  - Output subsidies may $\uparrow$ welfare but worsen environmental outcomes

- **Key insight:** Policy must jointly correct emissions, output distortion, and firm viability—single instruments are insufficient.
- **Implication:** Carefully designed **mixed or budget-balanced policies** can improve welfare by balancing these forces.