

Abatement Thresholds: *How Merger Prospects Affect Green Investments*

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WCERE, Lisbon - 2026

Motivation

- In several high-profile mergers, firms increased their green investments years before submitting the merger request.
 - Siemens invested \$1.2 billion in offshore wind R&D during 2015-16,
 - prior to its merger with Gamesa in April 2017.
 - Danish Ørsted invested \$1.5 billion in US wind and solar projects in 2016,
 - before merging with Lincoln Clean Energy in Aug 2018.
 - Schneider Electric invested \$800 million in smart grid and energy efficiency in 2017,
 - before merging with L&T in 2018.

Motivation

- Firms often portray these investments as part of their larger “sustainability goals.”
 - But can there be another reason?
- We show that these investments influence antitrust evaluations,
 - improving the chances of mergers being approved.
- We show the presence of “abatement thresholds”:
 - The AA approves the merger only when total industry abatement exceeds a minimum amount,
 - and the AA assigns a moderate weight on pollution.
 - Analogous in public good games with matching grants.

Literature

- Firms' abatement decisions.
 - Poyago-Theotoky (2007), Lambertini et al. (2017), and Strandholm et al. (2025), among others.
 - Assumes that abatement decisions do not affect merger incentives.
- Merger policy and imperfect competition.
 - Seminal work: Salant et al. (1983) Farrell and Shapiro (1990).
 - Mergers and pollution: Fikru and Gautier (2016, 2024).
 - No abatement.

- **Time structure (à la Poyago-Theotoky):**
 - Stage 1. Every firm $i = \{1, 2\}$ chooses its investment in abatement, z_i , where $e_i = q_i - z_i$.
 - Stage 2. The regulator responds with emission fee $t \geq 0$.
 - Stage 3. Firms choose whether to submit a merger request to the AA.
 - Stage 4. The AA responds approving or blocking the merger.
 - Stage 5. Firms choose their output levels.
- New stages *in italics*.
- Inverse demand function $p(Q) = 1 - Q$, and marginal cost $c \in [0, 1]$.

Model

- The EPA considers welfare

$$W = CS + PS + T - ED,$$

where $CS = \frac{Q^2}{2}$, $PS = \pi_1 + \pi_2$, $T = tE$ where $E = Q - Z$, and $ED = dE^2$, where $d \geq \frac{1}{2}$.

- The AA considers welfare

$$W = CS + PS + T - ED_{AA}$$

where $ED_{AA} = d_{AA}E^2$, where $0 \leq d_{AA} \leq d$. It embodies special cases:

- $d_{AA} = 0$ (ignoring pollution).
- $d_{AA} = d$ (full alignment with EPA).
- What about CS criterion? The AA's presence would be irrelevant.

Equilibrium Analysis

- **Fourth stage - Merger approval**

- The merger is welfare improving if and only if

$$d_{AA} \geq \bar{d}_{AA}(t, Z) \equiv \frac{5(1-c) + 7t}{2[7(1-c-t) - 12Z]},$$

where cutoff $\bar{d}_{AA}(t, Z)$ is unambiguously positive and increasing in t , Z , and c .

- The merger produces two well-known welfare effects:
 - less output (\downarrow welfare).
 - less emissions (\uparrow welfare).
- When d_{AA} is sufficiently high, the second effect dominates.
- High t and Z make the "emission-reduction benefit" of the merger less necessary.

Equilibrium Analysis

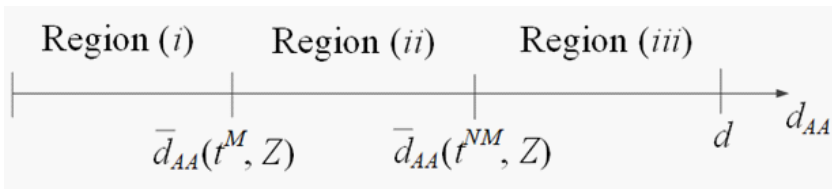
- **Second stage - Emission fee**

- If $d_{AA} \geq \bar{d}_{AA}(t^M, Z)$ holds, the EPA sets fee

$$t^M = \frac{(2d-1)(1-c)-4dZ}{2d+1}.$$

- Otherwise, the EPA sets fee $t^{NM} = \frac{(4d-1)(1-c)-6dZ}{2(2d+1)}$.

- Three regions:



Equilibrium Analysis

- **Second stage - Emission fee**
- Condition $d_{AA} \geq \bar{d}_{AA}(t^M, Z)$ can be rewritten as an "abatement threshold",

$$Z \geq Z^{Min} \equiv \frac{(1-c)(12d - 14d_{AA} - 1)}{2[7d + 2d_{AA}(d - 3)]}$$

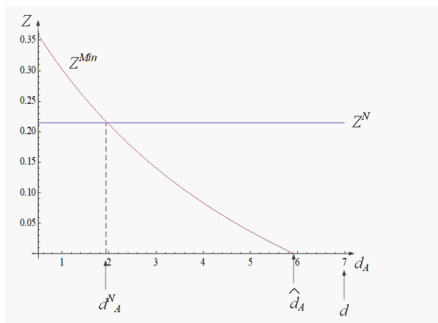
where Z^{Min} is increasing in d , but decreasing in d_{AA} .

- *Intuition:* Z^{Min} decreasing in d_{AA} .

Equilibrium Analysis

- **First stage - Proposition 1**

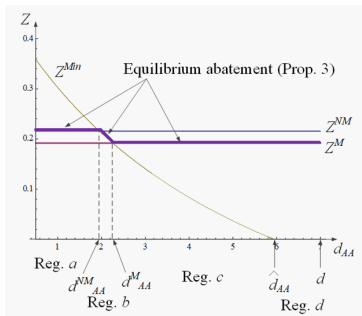
- $z_i^{NM} = \frac{(1-c)[4d(2d+1)-1]}{2(18d^2+13d+1)}$, which satisfies
 $z_i^{NM} + z_j^{NM} < Z^{Min}$ iff $d_{AA} < d_{AA}^{NM} \equiv \frac{d(15+52d)-1}{26+2d(39+8d)}$, where
 $d_{AA}^{NM} < d$.
- Z^{Min} decreases in d_{AA} , but Z^{NM} is constant.



Equilibrium Analysis

- **First stage - Proposition 2**

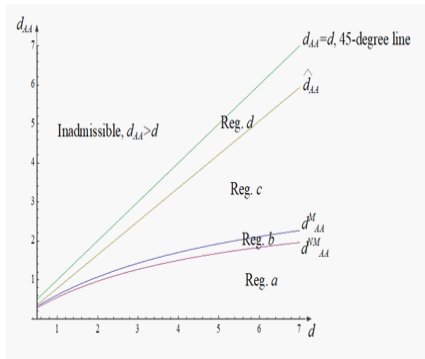
- $z_i^M = \frac{(1-c)[2d(2d+1)-1]}{4d(4+5d)+1}$, which satisfies $z_i^M + z_j^M \geq Z^{Min}$ iff $d_{AA} \geq d_{AA}^M \equiv \frac{d(26+64d)-1}{4d(23+4d)+38}$, where $d_{AA}^{NM} < d_{AA}^M < d$.
- In addition, $z_i^M < z_i^{NM}$.



Equilibrium Analysis

- **First stage - Proposition 3**

- Above results, but in terms of symmetry/asymmetry between agencies.



- For practitioners: Assign intermediate d_{AA} .

Extensions - I

- **Timing of regulation.**

- When abatement (or the emission fee) is set *before* the merger review:
 - firms strategically use z to influence approvals.
- When set *after* the review, this channel disappears:
 - later fees attain the first best, and the AA's role becomes inconsequential.

Extensions - II

- **Spillovers:**

- Can either help or hinder merger approvals.
- If spillovers reduce the abatement threshold Z^{Min} more than they reduce investment incentives, mergers are more likely.
- Otherwise, free-riding dominates and mergers become less likely.

- **Abatement costs:**

- Higher costs raise the threshold for merger approval.
- This makes it harder for firms to invest enough to trigger a merger.

- **Environmental R&D Cartels (ERCs):**

- Facilitate mergers when pollution is mild, even with regulatory asymmetries.
- Hinder mergers when pollution is severe, requiring closer alignment between agencies.

Thank you!

Other regulatory settings

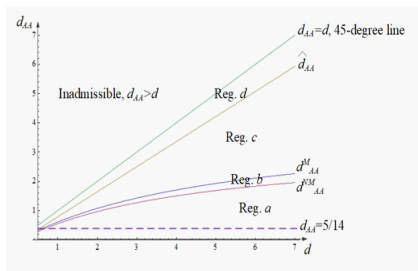
- **No AA**

- Firms can merge without legal constraints.
- They invest z_i^M .
- These results coincide with those when $d_{AA} > d_{AA}^M$ holds.
- Otherwise, firms invest *more* when the AA is present (z_i^{NM} or z_i^{Min}) than absent (z_i^M).

Other regulatory settings

- **No EPA**

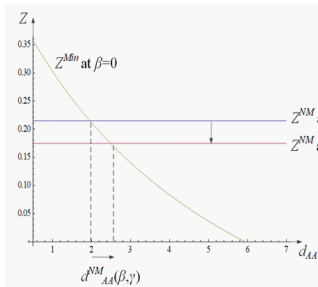
- The AA approves if $d_{AA} \geq \bar{d}_{AA}(0, Z) = \frac{5(1-c)}{2[7(1-c)-12Z]}$ since $t = 0$.
- But firms have no incentives to invest in abatement, $z = 0$.
- Then, $d_{AA} \geq \bar{d}_{AA}(0, 0) = \frac{5}{14}$ since $t = 0$.



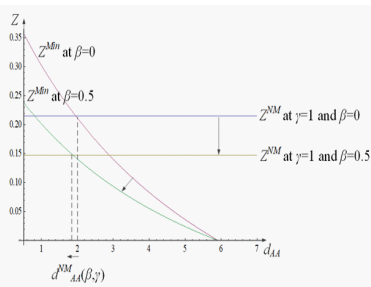
- More likely merger approvals.

Extensions

- Allowing for γ and β



Role of γ .

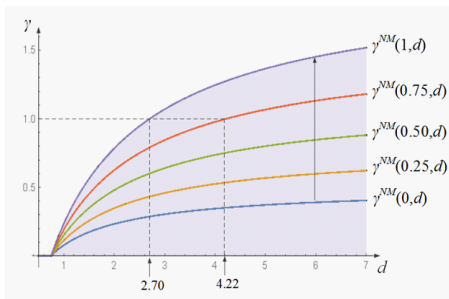


Role of β .

- $d_{AA}^{NM}(\beta, \gamma)$ unambiguously increases in γ .
- $d_{AA}^{NM}(\beta, \gamma)$ decreases in β if and only if $\gamma > \gamma^{NM}$, where γ^{NM} increases in both β and d .

Extensions

- Allowing for γ and β



- Emission fees are stringent (high d) and abatement is inexpensive (high γ).

Extensions

- **Allowing for cost convexities**

- Cutoff $Z^{Min}(h)$ rotates counterclockwise while Z^{NM} decreases in h .
- Which effect dominates?
- The latter, i.e., cutoff $d_{AA}^{NM}(h)$ increases in h .
- In English: the AA blocks the merger under a wider range of d_{AA} values.

