Lobbyism and Climate Regulation Measures

Funding the Enemy of my Enemy

G.A. Gruben

Faculty of Economics
(& Faculty of Laws)
FernUniversität Hagen

Seminar Environmental Economics, 16.–17. June 2023

FernUniversität in Hagen

Table of Contents

Figure: The aluminium industry is an example of a global price taker where domestic producers are assumed to be negatively hit by extra regulatory costs, due to high energy costs. (Source: shutterstock)

Domestic Producers hurt by regulation [EU]

In **2005, the EU established the European Emissions Trading System (EU-ETS), requiring industry to buy carbon certificates to reduce their emissions**. The programme played a key role in enabling the EU to meet its 2020 targets for CO2 five years early in 2015.
We join policymakers in celebrating this major achievement and are proud that today, European industry has a CO2 footprint that in most cases is several times better than our foreign competitors.
Yet, without a global climate agreement, this historic achievement had its costs. **Unlike our foreign competitors**, European industry has had to **make expensive investments in new technology and change its protocols in response to European climate and environmental policy**. Because **metals are globally priced commodities, we couldn't pass these costs onto consumers and remain competitive.**
The EU recognised this challenge to European industrial competitiveness, **creating a 'carbon leakage' protection mechanism to offset our costs**. Although the EU didn't want to see European industry **move abroad** to benefit from more lenient carbon policies, that's unfortunately exactly what happened.
As one example, **increasing regulatory costs resulted in the curtailment or closure of about 40 per cent of primary aluminium production in Europe since 2007**, leaving 1 in 6 employees out of work. Sadly today, many businesses in Europe are now dependent on aluminium and other metal imports when we are perfectly capable of making them here.

(O'Donoghue, Eurometaux, https://eurometaux.eu/blog/cop-21-why-it-s-time-for-a-level-playing-field/, retrieved: 06/02/2023)

Domestic Producers hurt by regulation [EU]

In **2005, the EU established the European Emissions Trading System (EU-ETS), requiring industry to buy carbon certificates to reduce their emissions**. The programme played a key role in enabling the EU to meet its 2020 targets for CO2 five years early in 2015.
We join policymakers in celebrating this major achievement and are proud that today, European industry has a CO2 footprint that in most cases is several times better than our foreign competitors.
Yet, without a global climate agreement, this historic achievement had its costs. **Unlike our foreign competitors**, European industry has had to **make expensive investments in new technology and change its protocols in response to European climate and environmental policy**. Because **metals are globally priced commodities, we couldn't pass these costs onto consumers and remain competitive.**
The EU recognised this challenge to European industrial competitiveness, **creating a 'carbon leakage' protection mechanism to offset our costs**. Although the EU didn't want to see European industry **move abroad** to benefit from more lenient carbon policies, that's unfortunately exactly what happened.
As one example, **increasing regulatory costs resulted in the curtailment or closure of about 40 per cent of primary aluminium production in Europe since 2007**, leaving 1 in 6 employees out of work. Sadly today, many businesses in Europe are now dependent on aluminium and other metal imports when we are perfectly capable of making them here.

(O'Donoghue, Eurometaux, https://eurometaux.eu/blog/cop-21-why-it-s-time-for-a-level-playing-field/, retrieved: 06/02/2023)

2003/87/EG $\longrightarrow$ TEHG ("Treibhausgas-Emissionshandelsgesetz")

Domestic Producers hurt by regulation [EU]

In **2005, the EU established the European Emissions Trading System (EU-ETS), requiring industry to buy carbon certificates to reduce their emissions**. The programme played a key role in enabling the EU to meet its 2020 targets for CO2 five years early in 2015.
We join policymakers in celebrating this major achievement and are proud that today, European industry has a CO2 footprint that in most cases is several times better than our foreign competitors.
Yet, without a global climate agreement, this historic achievement had its costs. **Unlike our foreign competitors**, European industry has had to **make expensive investments in new technology and change its protocols in response to European climate and environmental policy**. Because **metals are globally priced commodities, we couldn't pass these costs onto consumers and remain competitive.**
The EU recognised this challenge to European industrial competitiveness, **creating a 'carbon leakage' protection mechanism to offset our costs**. Although the EU didn't want to see European industry **move abroad** to benefit from more lenient carbon policies, that's unfortunately exactly what happened.
As one example, **increasing regulatory costs resulted in the curtailment or closure of about 40 per cent of primary aluminium production in Europe since 2007**, leaving 1 in 6 employees out of work. Sadly today, many businesses in Europe are now dependent on aluminium and other metal imports when we are perfectly capable of making them here.

(O'Donoghue, Eurometaux, https://eurometaux.eu/blog/cop-21-why-it-s-time-for-a-level-playing-field/, retrieved: 06/02/2023)

2003/87/EG ⟶ TEHG ("Treibhausgas-Emissionshandelsgesetz")

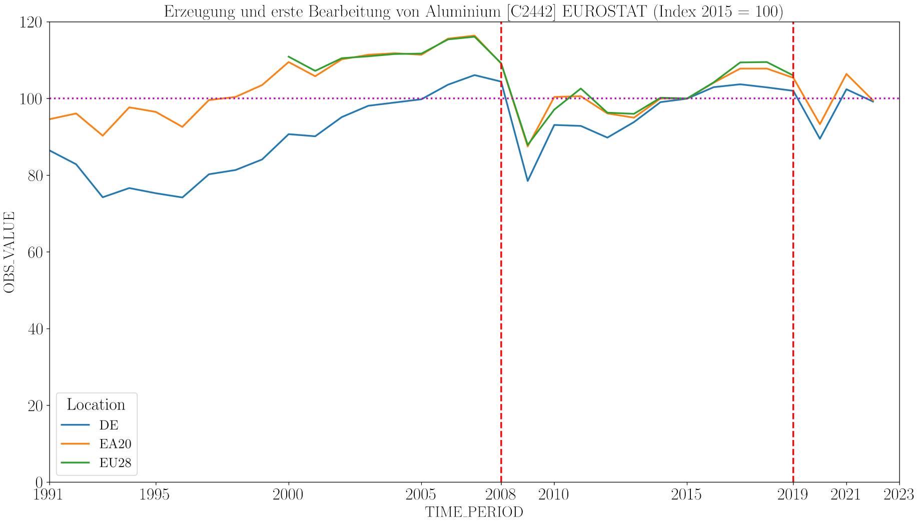
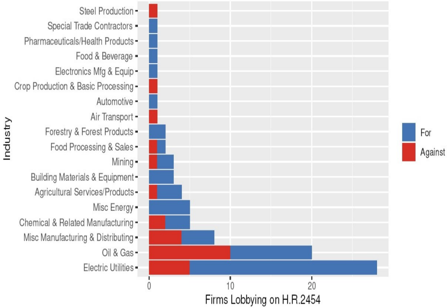
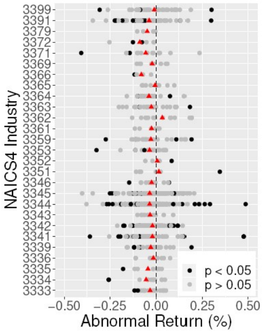


Figure: The production of the aluminium industry from 1991 to 2022 in Germany, the EU, and the Euro Area (incl. Croatia). In 2008 the second phase of the EU-ETS implementing the Kyoto Protocol started, but there was also the global financial crisis of 2007-08. (Source: own presentation, EUROSTAT)

Domestic Producers hurt by regulation? Waxman-Markey Bill [USA]



(a) Distribution of firms by industry lobbying for and against the American Clean Energy and Security Act H.R. 2454. (Source: Kennard, 2020, p. 12 of supp.)



(b) Analysis of abnormal returns after (house) passage of H.R. 2454 in 2009. (Source: ibid., p. 22 of suppl.)

Figure

Research Question

"Why do some firms support costly [climate change related] legislation while others continue to oppose?" (Kennard, 2020, p. 188)

Table of Contents

The regulation lobby game

Players: two companies, one policy maker (regulator)
Exogenous variables: $\overline{R}$, R, λ, a, ρ_1, ρ_2.

Phases

1. Initial Phase: companies and policy maker run a price-first menu auction. Regulation r is set.
2. Competition Phase: Cournot market competition. Production quantities Q_1, Q_2 are set.

Initial Phase

Companies

Simultaneously select *contribution schemes*,

$$s_i : [0, R] \xrightarrow{\mathcal{C}^2} \mathbb{R}_{\geq 0}.$$

Policy Maker's Objective

$$g(r \mid s_1, s_2, \overline{R}) = \lambda\omega(r) + (1 - \lambda)(s_1(r) + s_2(r)). \quad (1)$$

$\lambda \in [0, 1]$ weight ($\rightarrow$ regularization effect).
$\omega(r) = -(r - \overline{R})^2$ squared distance punishment term.

Competition Phase

1. Setting: homogeneous single good Cournot market.
2. Firms' cost given by $C^i(Q_i) = \frac{r}{\rho_i} Q_i$.
3. ρ_i is the *green capital* of the i-th firm. We assume $\rho_1 > \rho_2$, i.e. the first firm is the 'greener' one.
4. Inverse demand: $P = a - Q$.

Analysis of the competition

$$\pi_i(Q) = \Big[P(Q)Q_i - C^i(Q_i)\Big]_{\geq 0} = \left[\left(a - Q_1 - Q_2 - \frac{r}{\rho_i}\right) Q_i\right]_{\geq 0}. \qquad (2)$$

Analysis of the competition

$$\pi_i(Q) = \left[P(Q)Q_i - C^i(Q_i)\right]_{\geq 0} = \left[\left(a - Q_1 - Q_2 - \frac{r}{\rho_i}\right) Q_i\right]_{\geq 0}. \quad (2)$$

Proposition

If,

$$a > R\left(\frac{2}{\rho_2} - \frac{1}{\rho_1}\right) \quad (3)$$

then both companies are in the market, i.e. $Q_1^*, Q_2^* > 0$.

Analysis of the competition

$$\pi_i(Q) = \Big[P(Q)Q_i - C^i(Q_i)\Big]_{\geq 0} = \left[\left(a - Q_1 - Q_2 - \frac{r}{\rho_i}\right) Q_i\right]_{\geq 0}. \tag{2}$$

Proposition

If,

$$a > R\left(\frac{2}{\rho_2} - \frac{1}{\rho_1}\right) \tag{3}$$

then both companies are in the market, i.e. $Q_1^*, Q_2^* > 0$*.*

Proof.

After computing the first-order condition of π_i and the firms' reaction functions we obtain:

$$Q_i^* = \frac{a + r/\rho_j - 2r/\rho_i}{3} \tag{4}$$

Analysis of the competition

$$\pi_i(Q) = \left[P(Q)Q_i - C^i(Q_i)\right]_{\geq 0} = \left[\left(a - Q_1 - Q_2 - \frac{r}{\rho_i}\right) Q_i\right]_{\geq 0}. \quad (2)$$

Proposition

If,

$$a > R\left(\frac{2}{\rho_2} - \frac{1}{\rho_1}\right) \quad (3)$$

then both companies are in the market, i.e. $Q_1^*, Q_2^* > 0$.

Proof.

After computing the first-order condition of π_i and the firms' reaction functions we obtain:

$$Q_i^* = \frac{a + r/\rho_j - 2r/\rho_i}{3} =: \frac{1}{3}(a + r\gamma_i). \quad (4)$$

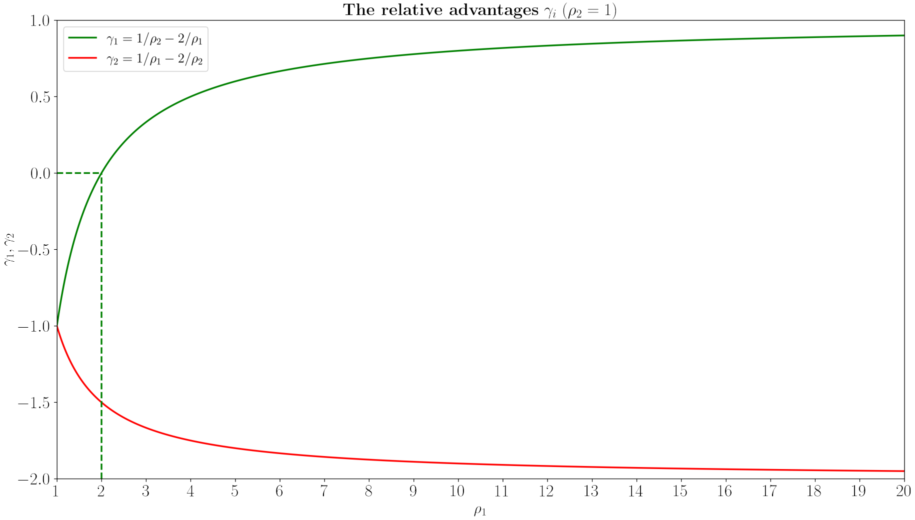


Figure: $\rho_2 = 1$, $1 \leq \rho_1 \leq 20$ to obtain the displayed factors γ_1 and γ_2. Once ρ_1 passes $2\rho_2$, then γ_1 is positive, i.e. the first company is called green.

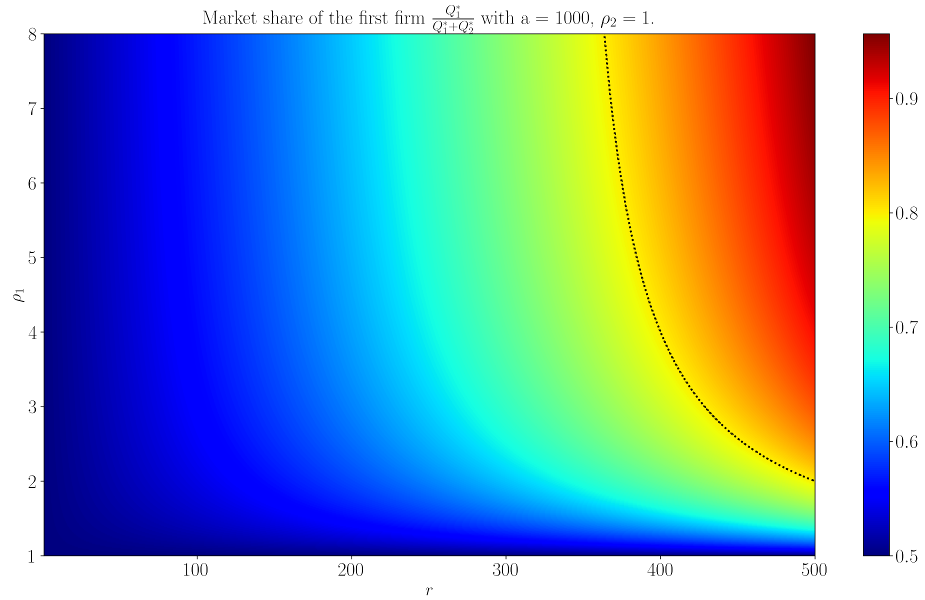


Figure: $\rho_2 = 1$ and $a = 1000$; varying r from 0 to $500 = \overline{R}$ and ρ_1 from 1 to 8. The market share of the greener firm in color. The black dashed line is the level curve for a market share of 80%.

Further Analysis

$$\pi_i^* = [(Q_i^*)^2]_{Q_i^* \geq 0} = \frac{1}{9}(a + r\gamma_i)^2 =: \pi_i^*(r). \tag{5}$$

Further Analysis

$$\pi_i^* = [(Q_i^*)^2]_{Q_i^* \geq 0} = \frac{1}{9}(a + r\gamma_i)^2 =: \pi_i^*(r). \quad (5)$$

Policy Analysis

$$r^* = \arg\max_r \{\lambda\omega(r) + (1-\lambda)(s_1(r) + s_2(r))\} \quad (6)$$

Further Analysis

$$\pi_i^* = [(Q_i^*)^2]_{Q_i^* \geq 0} = \frac{1}{9}(a + r\gamma_i)^2 =: \pi_i^*(r). \tag{5}$$

Policy Analysis

$$r^* = \arg\max_r \{\lambda\omega(r) + (1-\lambda)(s_1(r) + s_2(r))\} \tag{6}$$

$$r^* = \overline{R} + \frac{(1-\lambda)}{2\lambda}\left(\left.\frac{\partial s_1(r)}{\partial r}\right|_{r=r^*} + \left.\frac{\partial s_2(r)}{\partial r}\right|_{r=r^*}\right) \qquad \text{(FOC)} \tag{7}$$

Further Analysis

$$\pi_i^* = [(Q_i^*)^2]_{Q_i^* \geq 0} = \frac{1}{9}(a + r\gamma_i)^2 =: \pi_i^*(r). \tag{5}$$

Policy Analysis

$$r^* = \arg\max_r \{\lambda\omega(r) + (1-\lambda)(s_1(r) + s_2(r))\} \tag{6}$$

$$r^* = \overline{R} + \frac{(1-\lambda)}{2\lambda}\left(\left.\frac{\partial s_1(r)}{\partial r}\right|_{r=r^*} + \left.\frac{\partial s_2(r)}{\partial r}\right|_{r=r^*}\right) \qquad \text{(FOC)} \tag{7}$$

$$\left.\frac{\partial^2 s_1(r)}{\partial^2 r}\right|_{r=r^*} + \left.\frac{\partial^2 s_2(r)}{\partial^2 r}\right|_{r=r^*} < \frac{2\lambda}{1-\lambda} \qquad \text{(Concavity)} \tag{8}$$

$$\left.\frac{\partial s_i(r)}{\partial r}\right|_{r=\widetilde{r}^*} \stackrel{?}{=} \left.\frac{\partial \pi_i^*(r)}{\partial r}\right|_{r=\widetilde{r}^*} \tag{9}$$

$$\left.\frac{\partial s_i(r)}{\partial r}\right|_{r=\widetilde{r}^*} \stackrel{?}{=} \left.\frac{\partial \pi_i^*(r)}{\partial r}\right|_{r=\widetilde{r}^*} \tag{9}$$

Definition (Truthful Nash equilibria)

A firm's contribution schedule $s_i : R \rightarrow \mathbb{R}$ is defined to be *truthful relative to the equilibrium policy* r^*, iff.

$$\forall r' \in [0, R] : s_i(r') - s_i(r^*) = [\pi_i^*(r') - \pi_i^*(r^*)]_{\geq 0}$$

$$\left.\frac{\partial s_i(r)}{\partial r}\right|_{r=\widetilde{r}^*} \stackrel{?}{=} \left.\frac{\partial \pi_i^*(r)}{\partial r}\right|_{r=\widetilde{r}^*} \tag{9}$$

Definition (Truthful Nash equilibria)

A firm's contribution schedule $s_i : R \to \mathbb{R}$ is defined to be *truthful relative to the equilibrium policy* r^*, iff.

$$\forall r' \in [0, R] : s_i(r') - s_i(r^*) = [\pi_i^*(r') - \pi_i^*(r^*)]_{\geq 0}$$

A Nash equilibrium is *truthful*, if all firms' contribution schemes are truthful.

$$\left.\frac{\partial s_i(r)}{\partial r}\right|_{r=\tilde{r}^*} \stackrel{?}{=} \left.\frac{\partial \pi_i^*(r)}{\partial r}\right|_{r=\tilde{r}^*} \tag{9}$$

Definition (Truthful Nash equilibria)

A firm's contribution schedule $s_i : R \to \mathbb{R}$ is defined to be *truthful relative to the equilibrium policy* r^*, iff.

$$\forall r' \in [0, R] : s_i(r') - s_i(r^*) = [\pi_i^*(r') - \pi_i^*(r^*)]_{\geq 0}$$

A Nash equilibrium is *truthful*, if all firms' contribution schemes are truthful.

(Bernheim and Whinston, 1986, p. 12) for menu price auctions.

$$\left.\frac{\partial s_i(r)}{\partial r}\right|_{r=\widetilde{r}^*} = \left.\frac{\partial \pi_i^*(r)}{\partial r}\right|_{r=\widetilde{r}^*} \tag{9}$$

Definition (Truthful Nash equilibria)

A firm's contribution schedule $s_i : R \to \mathbb{R}$ is defined to be *truthful relative to the equilibrium policy* r^*, iff.

$$\forall r' \in [0, R] : s_i(r') - s_i(r^*) = [\pi_i^*(r') - \pi_i^*(r^*)]_{\geq 0}$$

A Nash equilibrium is *truthful*, if all firms' contribution schemes are truthful.

(Bernheim and Whinston, 1986, p. 12) for menu price auctions.

Making use of that..

Making use of that..

$$\left.\frac{\partial s_i(r)}{\partial r}\right|_{r=\widetilde{r}^*} = \left.\frac{\partial \pi_i^*(r)}{\partial r}\right|_{r=\widetilde{r}^*} = \frac{2\gamma_i}{9}(a+\widetilde{r}^*\gamma_i), \tag{10}$$

Making use of that..

$$\left.\frac{\partial s_i(r)}{\partial r}\right|_{r=\widetilde{r}^*} = \left.\frac{\partial \pi_i^*(r)}{\partial r}\right|_{r=\widetilde{r}^*} = \frac{2\gamma_i}{9}(a + \widetilde{r}^*\gamma_i), \tag{10}$$

$$\left.\frac{\partial^2 s_i(r)}{\partial^2 r}\right|_{r=\widetilde{r}^*} = \left.\frac{\partial}{\partial r}\left[\frac{\partial \pi_i^*(r)}{\partial r}\right]\right|_{r=\widetilde{r}^*} = \frac{2\gamma_i^2}{9}. \tag{11}$$

Nash-Equilibrium

Proposition

When

$$\lambda > \frac{\gamma_1^2 + \gamma_2^2}{9 + \gamma_1^2 + \gamma_2^2} =: \lambda_{min}, \ \textit{then} \tag{12}$$

$\exists!$ *(truthful) Nash equilibrium for the regulation lobby game.*

Nash-Equilibrium

Proposition

When

$$\lambda > \frac{\gamma_1^2 + \gamma_2^2}{9 + \gamma_1^2 + \gamma_2^2} =: \lambda_{min}, \text{ then} \tag{12}$$

$\exists!$ *(truthful) Nash equilibrium for the regulation lobby game.*

Proof.

Plugging (11) into (8), we get

$$\frac{2}{9}(\gamma_1^2 + \gamma_2^2) < \frac{2\lambda}{1-\lambda} = 2\beta. \tag{13}$$

Dividing by 2 and applying the function $x \mapsto x/(x+1)$ proves the theorem by noting that we are solving the regulation lobby game by backward induction (Gibbons, pp. 57–61). □

λ lower bound

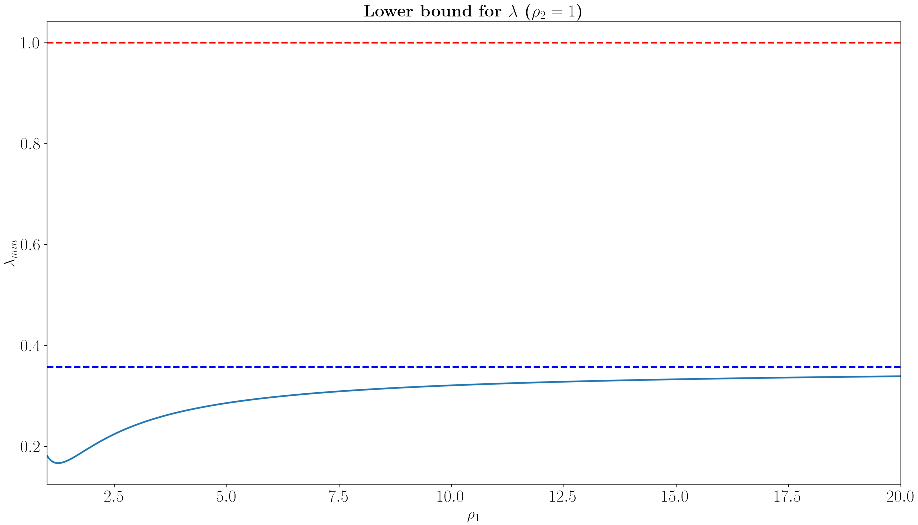


Figure: The lower bound $\lambda_{\min}$ plotted for $\rho_2 = 1 \le \rho_1 \le 20$. Note that the formula for the lower bound $\frac{\gamma_1^2+\gamma_2^2}{9+\gamma_1^2+\gamma_2^2}$ is equal to $\frac{5+\mathcal{O}(1/\rho_2)}{14+\mathcal{O}(1/\rho_2)} \to \frac{5}{14}$ $(\rho_2 \to \infty)$ marked as a blue dashed line in the graphic.

Equilibrium policy

Proposition

With $\beta = \lambda/(1-\lambda)$,

$$r^* = \min\left\{ \left[\frac{\overline{R} + \frac{1}{9} a\beta^{-1}(\gamma_1 + \gamma_2))}{1 - \frac{1}{9}\beta^{-1}(\gamma_1^2 + \gamma_2^2)} \right]_{\geq 0}, R \right\}. \tag{14}$$

Proof.

On the whiteboard! □

Goal is now to compute $s_i(r^*)$.

Goal is now to compute $s_i(r^*)$.

$$r_j^* = \arg\max_{r \in [0,R]} \left(-\lambda(\overline{R} - r)^2 + (1-\lambda) s_j(r) \right). \tag{15}$$

Goal is now to compute $s_i(r^*)$.

$$r_j^* = \arg\max_{r \in [0,R]} \left(-\lambda(\overline{R} - r)^2 + (1-\lambda) s_j(r) \right). \tag{15}$$

Similar to the proof of (14):

$$r_j^* = \left[\frac{\overline{R} + \frac{1}{9} a \beta^{-1} \gamma_j}{1 - \frac{1}{9} \beta^{-1} \gamma_j^2} \right]_{\geq 0} \tag{16}$$

Proposition

For $i, j \in [2], i \neq j$:

$$s_i(r^*) = \beta\left((\overline{R} - r^*)^2 - (\overline{R} - r_j^*)^2\right) + (\pi_j^*(r_j^*) - \pi_j^*(r^*)) \qquad (17)$$

Proof.

Whiteboard! □

Proposition

For $i, j \in [2], i \neq j$:

$$s_i(r^*) = \beta\left((\overline{R} - r^*)^2 - (\overline{R} - r_j^*)^2\right) + (\pi_j^*(r_j^*) - \pi_j^*(r^*)) \tag{17}$$

Proof.

Whiteboard! □

$$s_i(r) = [\pi_i^*(r) - \pi_i^*(r^*)]_{\geq 0} - \beta\left((\overline{R} - r^*)^2 - (\overline{R} - r_j^*)^2\right) + (\pi_j^*(r_j^*) - \pi_j^*(r^*))$$

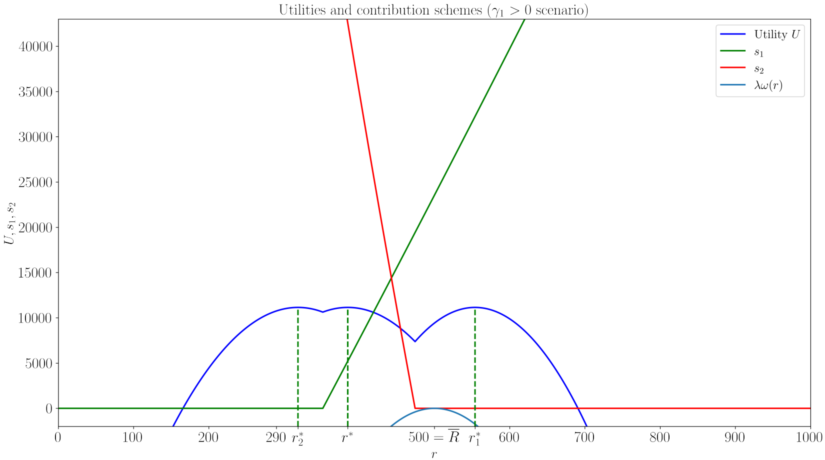


Figure: The parameters are $\overline{R} = 500, a = 2000, \rho_1 = 3, \rho_2 = 1, \lambda = 9/15$. The equilibrium policy turns out to be $r^* \approx 385$. Around the ideal policy $\overline{R} = 500$ one can see the weight term $\lambda\omega(r)$. The values of r_i^* are the optimal policy results if only firm i is in the game.

Degenerate Example

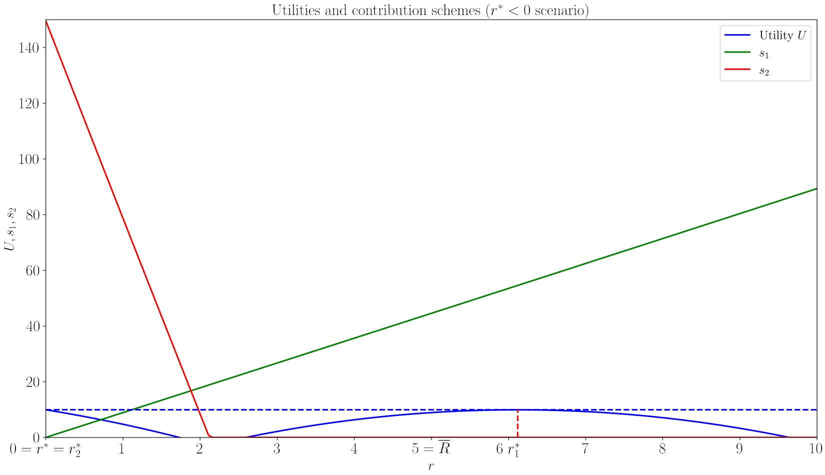


Figure: The parameters are $\overline{R} = 5, a = 200, \rho_1 = 5/2, \rho_2 = 1, \lambda = 8/10$. The equilibrium policy turns out to be $r^* = 0$, because the second company pushes $U(r = 0)$ just very slightly to a maximum for the policy maker, i.e. he is making no regulation at all. The problem here is that the cost functions will be zero as well. Both companies produce 66 2/3 units at a profit of 4444 4/9. $U(r^*) = 9.90977629464923$.

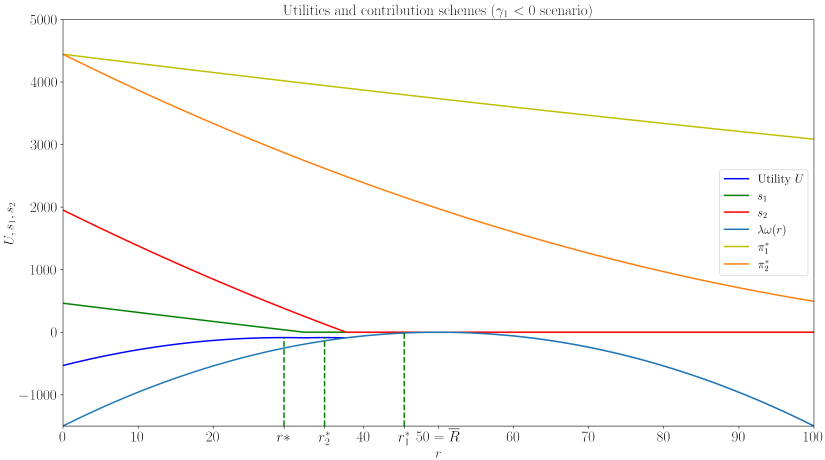


Figure: The parameters are $\overline{R} = 50, a = 200, \rho_1 = 1.5, \rho_2 = 1, \lambda = 9/15$. The equilibrium policy turns out to be $r^* \approx 385$. Around the ideal policy $\overline{R} = 500$ one can see the weight term $\lambda\omega(r)$. The values of r_i^* are the optimal policy results if only firm i is in the game.

Table of Contents

Extensions

1. Assume having N total firms, with M domestic firms in the set $\mathcal{M}$, possibly extended by $M - N$ foreign firms. Order them $\rho_1 > \rho_2 > \cdots > \rho_N$.

Extensions

1. Assume having N total firms, with M domestic firms in the set $\mathcal{M}$, possibly extended by $M - N$ foreign firms. Order them $\rho_1 > \rho_2 > \cdots > \rho_N$.
2. Firm i is green $\Leftrightarrow \rho_i > \frac{N}{M-1}\left(\frac{M-1}{\sum\limits_{j\in\mathcal{M}-\{i\}} \frac{1}{\rho_j}}\right)^M$.

Extensions

1. Assume having N total firms, with M domestic firms in the set $\mathcal{M}$, possibly extended by $M - N$ foreign firms. Order them $\rho_1 > \rho_2 > \cdots > \rho_N$.
2. Firm i is green $\Leftrightarrow \rho_i > \frac{N}{M-1} \left(\frac{M-1}{\sum_{j \in \mathcal{M}-\{i\}} \frac{1}{\rho_j}} \right)^M$.
3. Bertrand competition instead Cournot can be used!

Discussion

1. Lobbyism model pretty much follows the American two party system with donations known.
2. λ practically becomes more of a numerically helper instead of representing the "ideology" of the policy maker (and its electorate), though influence of companies really is comparatively low.
3. The assumption that all extra profit gained goes to the policy maker is unrealistic, especially due to information asymmetry.
4. Question: older, less green companies usually got more fixed capital. How would market entry be for "green" companies?
5. Is the $\gamma_1 > 0$ scenario realistic?

Sources

1. Kennard, A. (2020). The enemy of my enemy: When firms support climate change regulation. International Organization, 74(2), pp. 187–221.
2. Bernheim, B. D. and Whinston, M. D. (1986). Menu Auctions, Resource Allocation, and Economic Influence, The Quarterly Journal of Economics, 101(1), pp. 1–31.
3. Salop, S. C. and Scheffman, D. T. (1983). Raising rivals'costs. The American Economic Review, 73(2), pp. 267–271.
4. Gibbons, R. (1992). A primer in game theory. 1. edition, Wheatsheaf: New York.