Environmental Economics 4910

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Outline - Economics

- micro
- game theory
- public economics
- political economics
- development economics
- behavioral economics
- international trade
- macro

Environmental Problems

- Overusing/exploiting renewable and exhaustible resources
  - Atlantic northwest cod fishery has collapsed before... (1992).
- Land use changes (e.g. tropical deforestation)
  - football pitch cleared from the Amazon rainforest every minute.
- Waste (e.g. hazardous, or plastic)
  - 40 percent of plastic is used only once. An estimated five trillion pieces of plastic floating on and in the world's oceans.
- Water (over-usage, or contamination)
  - 9 percent of the world's population don't have access to safe drinking water. 40 percent of the world's population don't have proper sanitation (WHO).
- Air (particles, NO_x, acid rain; ozone layer)
  - Reduce life expectancy by 1y (LA), 4y (China), 9y (India).
- Greenhouse gases (e.g., CO_2)
  - UN goal: 2 (1,5)°C, but "93 percent chance that global warming will exceed 4C by the end of this century".

Classifications

- National vs. international
- Political vs. marked-based
- Number of sources and number of affected parties
- Affecting producers vs consumers
- Tangible vs. nonverifiable pollutants
- Flow pollutants vs. accumulating stocks
- Contemporary vs. long-term effects

Outline

1. Welfare theorems and market failures (micro)
2. Policy instruments (Pigou, Coase, Weitzman) (public ec.)
3. Trade and the environment (int. trade)
4. Self-enforcing vs. binding agreements (game theory)
5. Architectures for agreements (economic systems)
6. Free-riding and participation (contract theory)
7. Supply-side environmental policy (resource ec.)
8. Deforestation and REDD contracts (development ec.)
9. The value of the Future: Discounting (behavioral ec.)
10. Integrated Assessment Models (Traeger) (macro)

Consumption and Production: "ECON 101"

- Consumers i's utility and good j's production function:

$$u^i\left(x_1^i,...,x_J^i\right) \text{ and } \sum_i x_j^i \le f^j\left(y_j^1,...,y_j^K\right),$$

- ...where $i \in \{1,...,I\}$ consumes x_j^i of good $j \in \{1,...,J\}$, and y_j^k is the quantity of input $k \in \{1,...,K\}$ used in the production of good j.
- **Pareto optimality** (PO) requires that

$$\max_{\{x_j^i\},\{y_j^k\}} u^1\left(x_1^1,...,x_J^1\right) \text{ s.t.}$$

$$\begin{aligned} u^i\left(x_1^i,...,x_J^i\right) &\ge \overline{u}^i, \forall i && \text{(shadow value: } \lambda_i\text{)},\\ \sum_i x_j^i &\le f^j\left(y_j^1,...,y_j^K\right) \quad \forall j && \text{(shadow value: } \mu_j\text{)},\\ \sum_j y_j^k &\le \overline{y}^k \quad \forall k && \text{(shadow value: } \eta_k\text{)}. \end{aligned}$$

for some default levels ($\overline{u}^i$'s) and input quantities ($\overline{y}^k$'s).

- *Do we need to include labor/leisure in the model?*

Consumption and Production: Pareto Optimality

- Lagrange (/Kuhn-Tucker) problem with foc for x_j^i and y_j^k (if $\lambda_1 \equiv 1$):

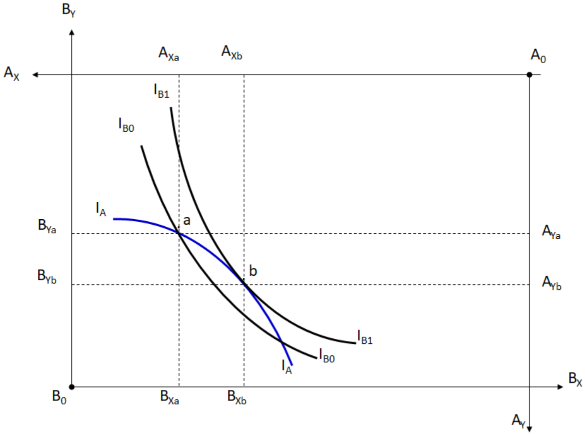
$$\begin{aligned} \lambda_i u_j^i &= \mu_j, \\ \mu_j f_k^j &= \eta_k. \end{aligned}$$

- The shadow values depend on the default levels; the $\overline{u}_i$'s.
- For PO, it is sufficient that the foc's hold for *some* shadow values.
- When the foc's are combined:

$$\begin{aligned} \frac{u_j^i}{u_{j'}^i} &= \frac{\mu_j}{\mu_{j'}} = \frac{u_k^{i'}}{u_l^{i'}} \ \forall \left(i, i'\right), \left(j, j'\right) \quad \text{(efficiency in consumption)}, \\ \frac{f_k^j}{f_{k'}^j} &= \frac{\eta_k}{\eta_{k'}} = \frac{f_k^{j'}}{f_{k'}^{j'}} \ \forall \left(k, k'\right), \left(j, j'\right) \quad \text{(efficiency in production)}, \\ \frac{u_j^i}{u_{j'}^i} &= \frac{f_k^{j'}}{f_k^j} \ \forall \left(j, j'\right), i, k \quad \text{(efficiency in exchange)}. \end{aligned}$$

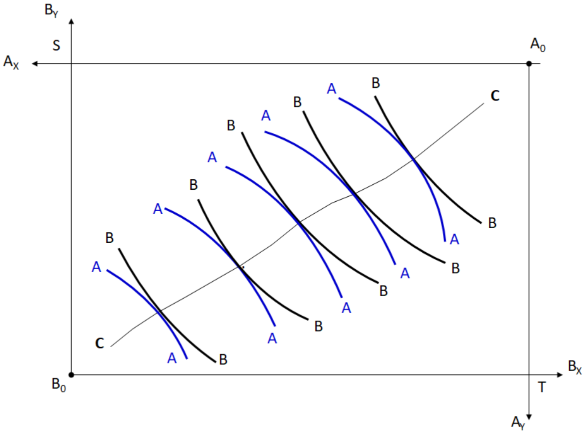
Consumption and Production: Pareto Optimality

Edgeworth box: 2 Individuals (A and B), 2 goods (X and Y)

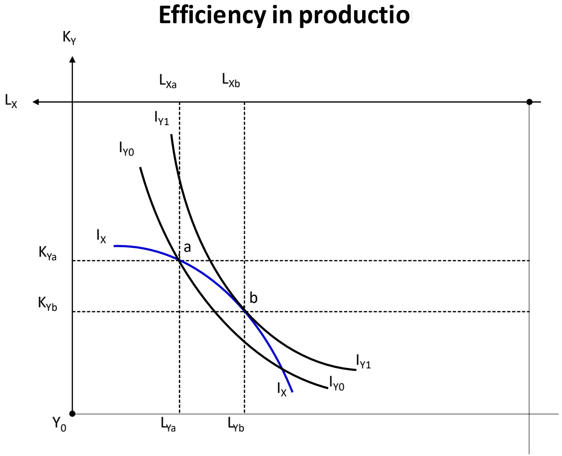


Consumption and Production: Pareto Optimality

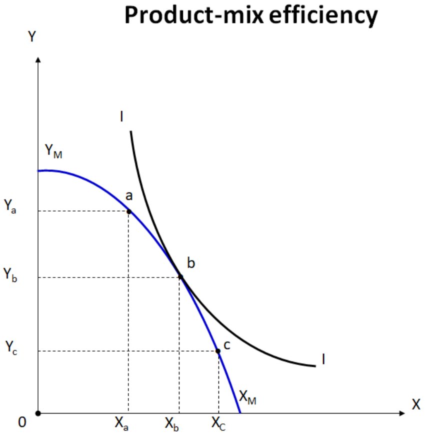
There many Pareto optimal allocations



Consumption and Production: Pareto Optimality



Consumption and Production: Pareto Optimality



Consumption and Production: Market Equilibrium

- Consumers' choice, given endowment E^i (with shadow value ν_i):

$$\max_{\{x_j^i\}_j} u^i\left(x_1^i, ..., x_J^i\right) \text{ s.t. } \sum_j p_j x_j^i \leq E^i \quad (\nu_i) \Rightarrow u_j^i = \nu_i p_j.$$

- Producers:

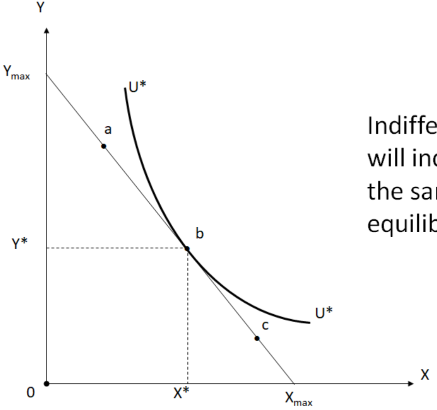
$$\max p_j f^j\left(y_j^1, ..., y_j^K\right) - \sum_k w^k y_j^k \Rightarrow p_j f_k^j = w^k.$$

- Combined:

$$\begin{aligned}
\frac{u_j^i}{u_{j'}^i} &= \frac{\mu_j}{\mu_{j'}} = \frac{u_j^{i'}}{u_{j'}^{i'}} \text{ if just } \mu_j = p_j, \\
\frac{f_k^j}{f_{k'}^j} &= \frac{\eta_k}{\eta_{k'}} = \frac{f_k^{j'}}{f_{k'}^{j'}} \text{ if just } \eta_k = w^k, \\
\frac{u_j^i}{u_{j'}^i} &= \frac{f_k^{j'}}{f_k^j} = \frac{p_j}{p_{j'}} \ \forall \left(j, j'\right), i, k.
\end{aligned}$$

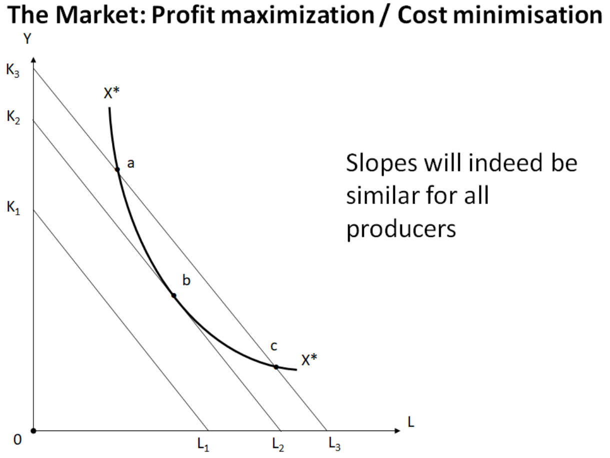
Consumption and Production: Market Equilibrium

The Market: Utility maximisation for a given budget



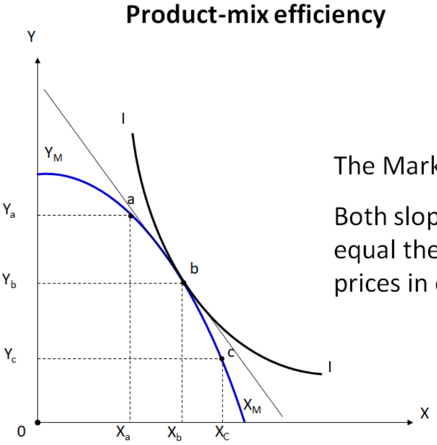
Indifference curves will indeed have the same slopes in equilibrium

Consumption and Production: Market Equilibrium



Slopes will indeed be similar for all producers

Consumption and Production: Market Equilibrium



The Market:

Both slopes will equal the relative prices in equilibrium

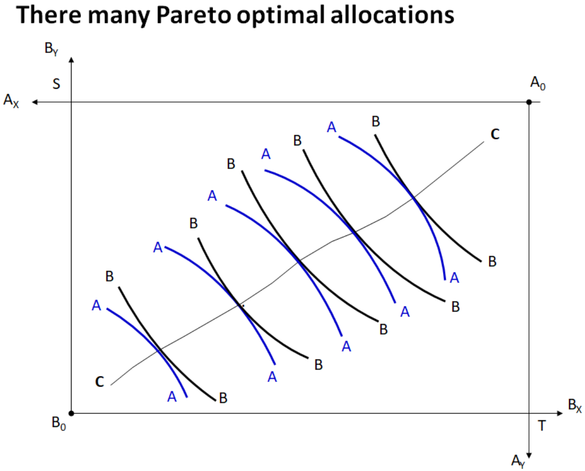
Consumption and Production: Welfare Theorems

Theorem

1. *Every market equilibrium $\Rightarrow$ Pareto optimal.*
2. *Every Pareto optimal outcome $\Rightarrow$ market equilibrium – given some allocation of endowments.*

- Where is the environment?

The final allocation depends on the endowments



Consumption and Production: With Externalities

- Externalities from inputs/productions to consumers:

$$u^i\left(x_1^i, ..., x_J^i, \sum_j g_j\right) \text{ and } \sum_i x_j^i \leq f^j\left(y_j^1, ..., y_j^K, g_j\right).$$

- Pareto Optimality is given by the same conditions as above, plus:

$$\mu_j f_g^j = \sum_i \lambda_i \left(-u_g^i\right) = \sum_i \frac{\mu_j}{u_j^i}\left(-u_g^i\right) \Rightarrow f_g^j = \sum_i \frac{-u_g^i}{u_j^i}.$$

- Market equilibrium with no regulation: j emits until $f_g^j = 0$.
- With regulation or tax t_g^j on j's emission: $p_j f_g^j = t_g^j$
- This coincides with the PO outcome if

$$f_g^j = \frac{t_g^j}{p_j} = \sum_i \frac{-u_g^i}{u_j^i} = \sum_i \frac{-u_g^i}{p_j u_1^i / p_1} \Rightarrow t_g^j = \sum_i \frac{-u_g^i}{u_1^i} p_1.$$

- So, the emission **tax should be the same for all firms**, no matter how valuable/dirty they are.

Consumption and Production: With Externalities (cont.)

- If there is a numeraire good (i.e., $u_1^i = 1 = p_1$), then $t_g^j = -\sum_i u_g^i$.
- Alternatively, the regulator may decide on the g_j's directly.
- For each such policy, there will be equilibrium prices and quantities such that payoffs are functions $u_i(\mathbf{g})$ and profits $\pi_j(\mathbf{g})$.
- Larger g_j's is likely to benefit producer j $(B_j(g_j))$ but be costly for consumers $(C_i(g_j))$.

- Let g_i be emission by *agent* $i \in N \equiv \{1, ..., n\}$, and $\mathbf{g} = \{g_1, ..., g_n\}$.
- **Externalities:**

$$u_i(\mathbf{g}) = B_i(g_i) - C_i(\mathbf{g}), \text{ if } \partial C_i / \partial g_j \neq 0 \text{ for some } j \neq i.$$

- **Uniformly mixing pollutant (and public good/bad):**

$$u_i(\mathbf{g}) = u_i(g_i, G) = B_i(g_i) - C_i(G), \text{ where } G = \sum_{j \in N} g_j.$$

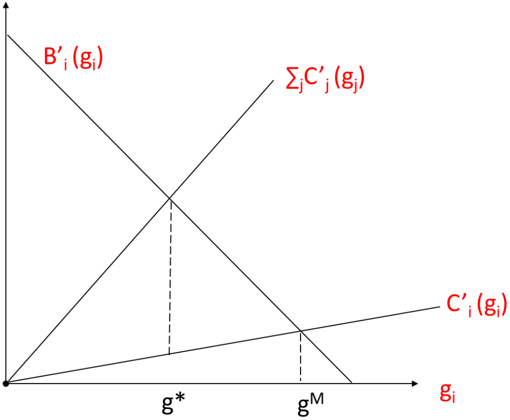
- To get an interior solution, assume u_i is concave in g_i
  - For example: Every B_i is concave while C_i is convex.
- **Business as usual** (interior) equilibrium:

$$B_i'(g_i) = C_i'(G).$$

- Suppose transfers enter linearly and additively in u_i.
- **The first-best** (FB; the unique PO outcome with transfers):

$$B_i'(g_i^*) = \sum_{j \in N} C_j'(G^*).$$

Every polluter “i“ emits too much



Pigou Taxes (The "Incorrect Prices" Approach)

- Suppose i pays $t_i g_i$ and receives $T_i(\mathbf{g})$.
- Then, in equilibrium:

$$\frac{\partial B_i(g_i)}{\partial g_i} = C_i'(G) + t_i - \frac{\partial T_i(\mathbf{g})}{\partial g_i}.$$

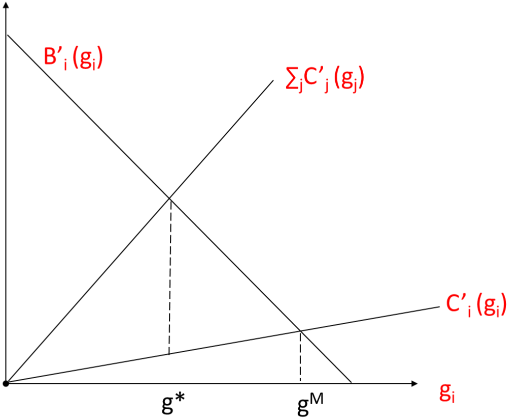
  - Equivalent: A *subsidy* $T_i(\mathbf{g}) - t_i g_i$, f.ex. $t_i \cdot (\overline{g}_i - g_i)$.
- This coincides with the first-best if:

$$t_i = \sum_{j \in N \setminus i} C_j'(G) \text{ and } \frac{\partial T_i(\mathbf{g})}{\partial g_i} = 0.$$

- *No earmarking*: It is (almost) irrelevant how tax revenues are spent.
  - For example: $T_i(\mathbf{g}) = \sum_{j \in N \setminus i} t_j g_j / (n-1)$.
- If $C_i' \approx 0$ for each emitter i, the linear tax is the same for all:

$$t = \sum_{j \in N} C_j'(G^*) \Rightarrow B_i'(g_i) = \sum_{j \in N} C_j'(G^*).$$

Every polluter “i“ emits too much



Pigou Taxes - Uncertainty

- Facing the same tax, we get:

$$B_i'(g_i, \epsilon_i) = t = B_j'(g_j, \epsilon_j)\,\forall\,(i,j) \in N^2$$

even if individual shocks (ϵ_i) are private information.

- Then, define $\boldsymbol{\epsilon} = (\epsilon_1, ..., \epsilon_n)$ and

$$B(t, \boldsymbol{\epsilon}) \equiv \sum_{i \in N} B_i\left(B_i'^{-1}(t, \epsilon_i), \epsilon_i\right).$$

- The optimal tax is given by:

$$\max_t \mathrm{E}\left[B(t, \boldsymbol{\epsilon}) - C\left(\sum_{i \in N} B_i'^{-1}(t, \epsilon_i)\right)\right].$$

Pigou Taxes - Uncertainty - Example Q

- Consider the quadratic approximation (Y=exp. "bliss" point):

$$B(G,\epsilon) = -\frac{b}{2}(Y-G-\epsilon)^2 \text{ and } C(G) = \frac{c}{2}G^2,$$

where the aggregate shock is $\epsilon \in \mathbb{R}$, $\mathrm{E}\epsilon = 0$, and variance $\mathrm{E}\epsilon^2 = \sigma_\epsilon^2$.

- The equilibrium, given t:

$$\max_G -\frac{b}{2}(Y-G-\epsilon)^2 - tG \Rightarrow b(Y-G-\epsilon) = t.$$

- The tax pins down B' and B, leaving the uncertainty to G and $C(G)$.
- The optimal t:

$$\max_t -\frac{t^2}{2b} - \mathrm{E}\frac{c}{2}(Y-\epsilon-t/b)^2 \Rightarrow t^* = c(Y-t^*/b) = \frac{cbY}{b+c}.$$

- The uncertainty does not influence the optimal level of t. (Why?)
- **Welfare loss** relative to no uncertainty increases in c:

$$L_t^\epsilon = \frac{c\sigma_\epsilon^2}{2}.$$

Pigou Taxes and Tax Revenues

- Tax revenues (at the above optimal t^*):

$$\mathrm{E}tG = \mathrm{E}\frac{cbY}{b+c}\left(Y - \epsilon - \frac{cY}{b+c}\right) = \frac{cb^2Y^2}{b+c}.$$

- Tax revenues (at general t):

$$t\left(Y - \epsilon - t/b\right)$$

- Normally, revenues necessitate distortionary taxes.
- With the social value λ, the optimal t is thus:

$$\max_t -\frac{t^2}{2b} - \mathrm{E}\frac{c}{2}\left(Y - \epsilon - t/b\right)^2 + \mathrm{E}\lambda t\left(Y - \epsilon - t/b\right) \Rightarrow$$

$$t = c\left(Y - t/b\right) + \lambda b\left(Y - 2t/b\right) = \frac{cb + \lambda b^2}{b + c + 2\lambda b}Y.$$

- which can be increasing or decreasing in λ...
- Q: (When) is there a "double dividend"?

Pigou Taxes and 'Double Dividend'

Proposition

1. *Weak form: The regulation with Pigou tax revenues raises social efficiency relatively to regulation without tax revenues.*
   - *Holds trivially*
2. *Strong form: The optimal tax is larger than the Pigovian level.*
   - *The strong form may or may not hold.*

Coase (The "Property Rights" Approach)

- As long as the property rights are well defined, bargaining among the parties lead to an efficient outcome.
- The "Chicago school" argues that an externality does NOT imply that the government should act.
- Instead, the parties have an incentive to sort things out themselves.
- If an upstream polluter harms a downstream water consumer, the two will both benefit from coming to some kind of agreement.
- Coase (1960) uses the example of a cattle ranger and a farmer.
- With G cows, the benefit (profit) to the cattle ranger may be $B(G) = (20 - G) G$.

$$B(G+1) - B(G) = 19 - 2G.$$

- The cost (damage) to the farmer may be $C(G) = 6G$.
- The optimal number G^* is 7.

Coase (The "Property Rights" Approach)

- If the "property right" belongs to the farmer, $G_0 = 0$.
  - The cattle ranger is willing to compensate the farmer for the damages as long as $G \leq 7$.
- If the "property right" belongs to the cattle ranger, $G_0 = 10$.
  - The farmer is willing to compensate the cattle ranger for reducing G as long as $G > 7$.
- Under "liability law", both can do as they want, but the cattle ranger must compensate the farmer for any damages.
  - Again, the equilibrium is 7.
  - This holds regardless of *how* the property rights are allocated.

Coase (The "Property Rights" Approach)

- Suppose disagreement leads to the "default" payoffs u_i^D. For example, u_i^D may equal $u_i\left(\mathbf{g}^{BAU}\right)$.
- To negotiate a better outcome, a "proposer", i, would prefer to:

$$\begin{aligned} \max_{\mathbf{g},\mathbf{t}} u_i &= B_i\left(g_i\right) - C_i\left(G\right) - t_i \text{ s.t.} \\ u_j &= B_j\left(g_j\right) - C_j\left(G\right) - t_j \geq u_j^D \text{ (IR}_j\text{).} \end{aligned}$$

- With budget balance, $t_i = -\sum_{j \in N \setminus i} t_j$, so i prefers the largest t_j's satisfying IR$_j$.
- IR$_j$ can be substituted into u_i, so that i maximizes:

$$\begin{aligned} \max_{\mathbf{g},\mathbf{t}} u_i &= B_i\left(g_i\right) - C_i\left(G\right) + \sum_{j \in N \setminus i}\left[B_j\left(g_j\right) - C_j\left(G\right) - u_j^D\right] \\ &= \sum_{j \in N}\left[B_j\left(g_j\right) - C_j\left(G\right)\right] - \sum_{j \in N \setminus i} u_j^D = \sum_{j \in N} u_j\left(\mathbf{g}^*\right) - \sum_{j \in N \setminus i} u_j^D. \end{aligned}$$

- In other words: i maximizes the sum of payoffs (minus a constant).
- Consequently, the proposed g_j's coincides with the first best.

Coase Theorem (1960)

Theorem

- *The parties negotiate the efficient outcome, regardless of the initial allocation of property rights (i.e., the default outcome, u_j^D) as long as there are no 'transaction costs.'*

- For example, u_j^D may reflect BAU (i.e., everyone has the "right" to emit as much as they want), or u_j^D could be $u_j(\mathbf{0})$, i.e., no-one has the right to emit anything.
- "Transaction costs" (tc_i) must be sufficiently small:

$$tc_i \leq \sum_{j \in N} \left[u_j(\mathbf{g}^*) - u_j^D \right].$$

- Q: What is this "transaction cost"?
- Q: Who should have the bargaining power? What should the property rights be, if there are substantial transaction costs?

Emssion Trading Systems (ETS): A Brief History

- Theory by Coase '60, Crocker '66, Dales '68, Montgomery '72
- Computer simlulates late 60s by the EPA
- 1977 Clean Air Act: Permitted "offset-mechanism"
- 1990 Clean Air Act: Cap-and-trade in (SO2)
  - cost savings of $700–$800m/year compared to uniform emission rate standard (Carlson et al. '00 JPE)
  - SO2 emissions were reduced by 50% from 1980 levels by 2007
- 1997: Kyoto: CDM and JI
- 2005: EU ETS: First and largest CO2 ETS
- RGGI, WCI, China (2021?)
- Linkages considered, but no global system

Trading Pollution Permits ("Missing Market")

- If i has the right to emit Q_i^0, while j has the right to emit Q_j^0, the two might benefit from trading without increasing total emission:

$$g_i + g_j \leq Q_i^0 + Q_j^0.$$

- That is, if i emits g_i and sell $Q_i^0 - g_i$, j can emit g_j from buying $g_j - Q_j^0 = Q_i^0 - g_i$ from i.
- This trade is beneficial as long as $B_i' < B_j'$.
- With efficient trade, $B_i' = B_j'$.
- More generally, a proposer i prefers to:

$$\begin{aligned}
\max_{\mathbf{g},\mathbf{t}} u_i &= B_i(g_i) - C_i(G) - t_i \text{ s.t.} \\
u_j &= B_j(g_j) - C_j(G) - t_j \geq u_j^D \ (\text{IR}_j) \text{ and} \\
G &= \sum_{j \in N} g_j \leq \sum_{j \in N} Q_j^0 \text{ and } \sum_{j \in N} t_j \geq 0.
\end{aligned}$$

- Consequently, $B_i' = B_j'$ for all pairs (i, j)
- ...regardless of the endowments, i.e., u_j^D.

Perfect Pollution Markets ("Missing Market")

- If $n \to \infty$, every i is likely to take the permit price p as given.
- If i owns Q_i^0 permits already, i solves

$$\max_{g_i} B_i\left(g_i\right) - C_i\left(G\right) - p\left(g_i - Q_i^0\right) \Rightarrow B_i'\left(g_i\right) = p,$$

  since $G = \sum_{j \in N} Q_j^0$ is independent of g_i.
- The outcome is FB if:

$$p = \sum_{j \in N} C_j'\left(G^*\right).$$

- I.e., the outcome is FB if the quantity (and thus the price) is "right", i.e., if:

$$B_i'\left(g_i\right) = p = \sum_{j \in N} C_j'\left(G^*\right).$$

Perfect Pollution Markets ("Missing Market")

Proposition

- *When each emitter is a price-taker, the permit market equilibrium is efficient, regardless of the initial allocation of rights.*

- So, permit trade => FB whether n is small or $n = \infty$.
  - Should we expect FB for any n? Why/why not?
- Q: Why is the initial allocation (Q_i^0) irrelevant?
- Q: Is that useful for the regulator? How will the regulator decide on the initial endowments? Must Q_i^0 be exogenous?
- What if Q_i^0 depends on past production or past emissions?
- Montgomery '72: With $G_j = \sum_{i \in N} h_{ij} g_i$, the FB requires:

$$B_i'(g_i) = \sum_{j \in N} h_{ij} C_j'\left(G_j^*\right) \Rightarrow \text{Pollution markets FB iff } p_j = C_j'.$$

Prices vs. Quantities (Weitzman '74)

Proposition

- *The efficiency loss under quotas is smaller than under prices/taxes* ($L_G^{\epsilon} < L_t^{\epsilon}$) *IFF* $b < c$.

Perfect Pollution Markets - Uncertainty

- Consider the quadratic approximation (Y=exp. "bliss" point):

$$B(G,\epsilon) = -\frac{b}{2}(Y - G - \epsilon)^2 \text{ and } C(G) = \frac{c}{2}G^2,$$

where the aggregate shock is $\epsilon \in \mathbb{R}$, $\mathrm{E}\epsilon = 0$, and variance $\mathrm{E}\epsilon^2 = \sigma_\epsilon^2$.

- With uncertainty, the optimal cap is

$$\begin{aligned} & \max_G \mathrm{E}B(G,\epsilon) - C(G) = \max_G \mathrm{E} - \frac{b}{2}(Y - G - \epsilon)^2 - \frac{c}{2}G^2 \\ = & \max_G \mathrm{E} - \frac{b}{2}\left[(Y-G)^2 - 2\epsilon(Y-G) + \epsilon^2\right] - \frac{c}{2}G^2 \\ = & \max_G -\frac{b}{2}\left[(Y-G)^2 + \sigma_\epsilon^2\right] - \frac{c}{2}G^2 \Rightarrow G^* = \frac{b}{c+b}Y. \end{aligned}$$

- The shock does not affect G, but only B'.
- Relative to no uncertainty, the welfare loss is:

$$L_G^\epsilon = \frac{b\sigma_\epsilon^2}{2}.$$

Pigou Taxes - Uncertainty - Example Q

- The equilibrium, given emission tax t:

$$\max_G -\frac{b}{2}(Y-G-\epsilon)^2 - tG \quad \Rightarrow \quad b(Y-G-\epsilon) = t$$
$$\Rightarrow \quad G = Y - \epsilon - t/b.$$

- So, G becomes stochastic. The optimal t:

$$\begin{aligned} & \max_t -\frac{t^2}{2b} - \mathrm{E}\frac{c}{2}\left(Y-\epsilon-\frac{t}{b}\right)^2 \\ = \quad & \max_t -\frac{t^2}{2b} - \mathrm{E}\frac{c}{2}\left[\left(Y-\frac{t}{b}\right)^2 - 2\epsilon\left(Y-\frac{t}{b}\right) + \epsilon^2\right] \\ = \quad & \max_t -\frac{t^2}{2b} - \frac{c}{2}\left[\left(Y-\frac{t}{b}\right)^2 + \sigma_\epsilon^2\right] \Rightarrow t^* = \frac{cbY}{b+c}. \end{aligned}$$

- The uncertainty does not influence t^*, but **Welfare loss** is:

$$L_t^\epsilon = \frac{c\sigma_\epsilon^2}{2}.$$

Prices vs. Quantities (Weitzman '74)

Proposition

- *The efficiency loss under quotas is smaller than under prices/taxes,* $L_G^\epsilon < L_t^\epsilon$*, IFF* $b < c$.

- This holds generally when B and C are approximated by quadratic functions, no matter the distribution of errors, and even if there are (additive) shocks in the C function.
- Q: How can the losses be reduced further?
- By hybrid schemes?
- Floor/ceiling for price?

Prices vs. Quantities: Revenues

- Pigou taxes raises revenues, which has an additional benefit:

$$tG = \frac{cbY}{b+c}\left(Y - \epsilon - \frac{cY}{b+c}\right)$$

- The willingness to pay for a quota is B', so the revenues when auctioning the initial quota endowments are:

$$\frac{b}{c+b}Yb\left(Y - \frac{b}{c+b}Y - \epsilon\right) = \frac{b^2 Y}{c+b}\left(\frac{c}{c+b}Y - \epsilon\right).$$

- This has the same mean as the expected Pigou tax revenues.
- The variance of the auction revenues is smaller IFF $b < c$.
- This adds to the benefits of quotas, rather than taxes, IFF $b < c$.

Prices vs. Quantities: Discussion

- What other things determine the choice of policy instrument?
- Why are quotas more often seen in practice, than Pigou taxes?
- Why do firms prefer (tradable permits)?
- If firms like to be compensated, why can't tax revenues return to firms, instead of free tradable permits?
- What do you thing left-wing and right-wing policy makers prefer?
- If the two wings must negotiate, what do you think they will agree on?