Chapter 35 - Externalities

→ An externality occurs when an economic agent is affected by the production or consumption decisions of other agent(s).

→ externalities may be positive or negative

e.g. Painting my house a pleasant color may confer positive externalities on my neighbors.

Painting my house a garish color may confer negative externalities on my neighbors.

→ consumption externalities stem from one agent's consumption decisions affecting another's ~~consumption~~ production or consumption ~~decisions~~

→ e.g. your liking quiet at night may prevent your ~~roommate~~ roommate from producing ~~rock~~ music.

→ production externalities stem from one agents production decisions affecting the production or consumption of others

→ e.g. band practice by your roommate may prevent you from consuming sleep

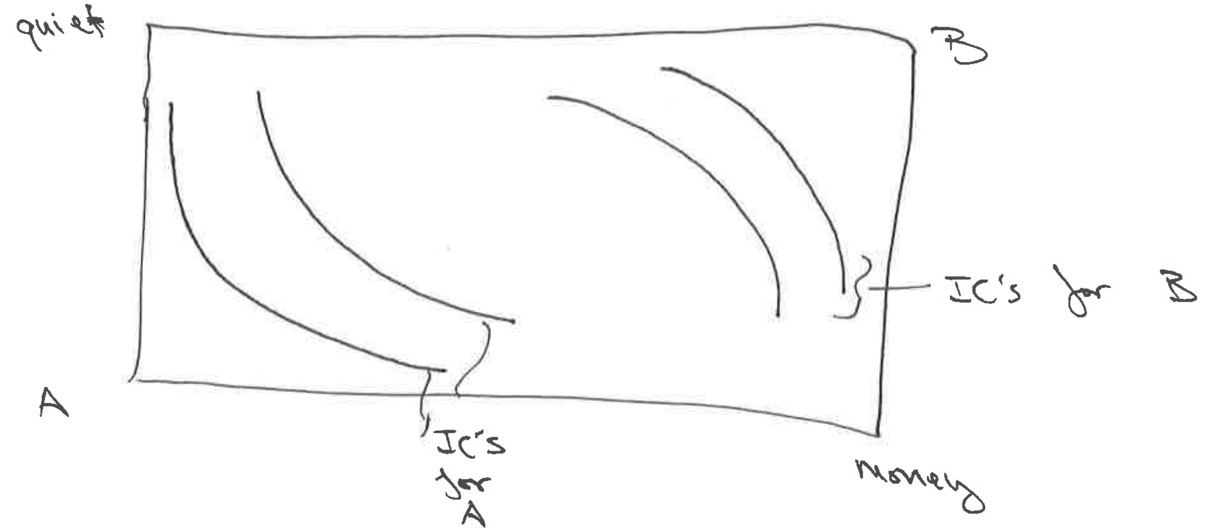
→ important point → it takes 2 (or more) to create an externality

→ you wanting quiet and your roommate wanting to practice are both necessary

→ it's no one's fault

A market for externalities

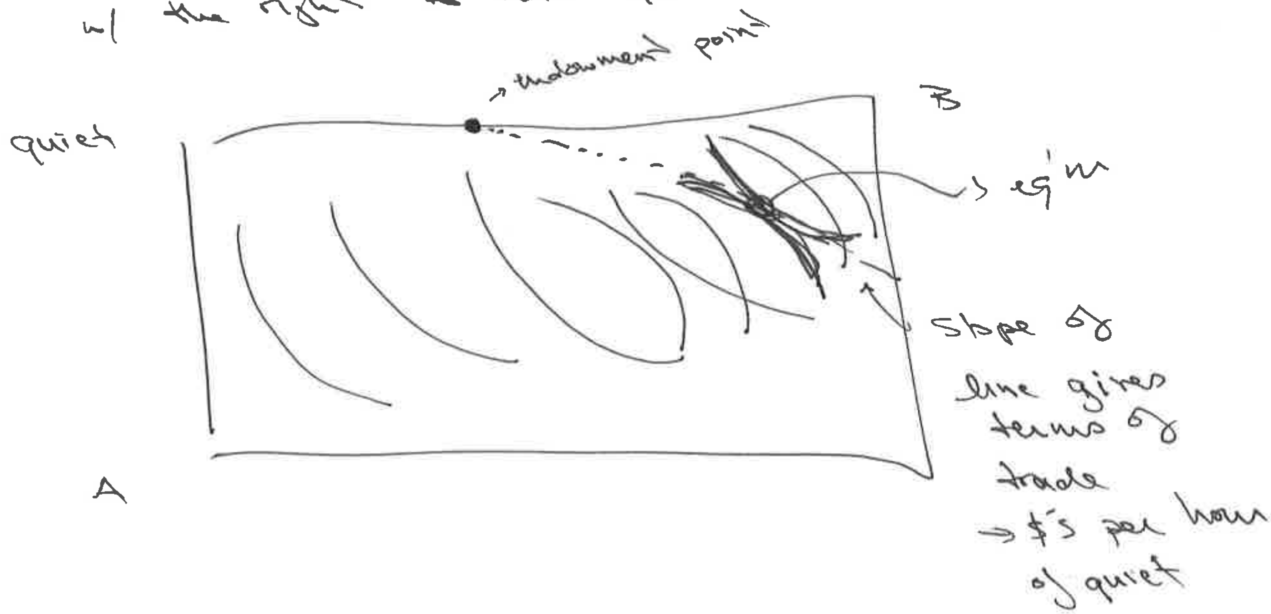
- extend this 2 roommate example - one who likes to sleep and the other who likes to practice w/ his band
- assume both have (and value) money. ~~and the~~
- roommate A values quiet hours
- roommate B values noisy hours (non-quiet for band practice)



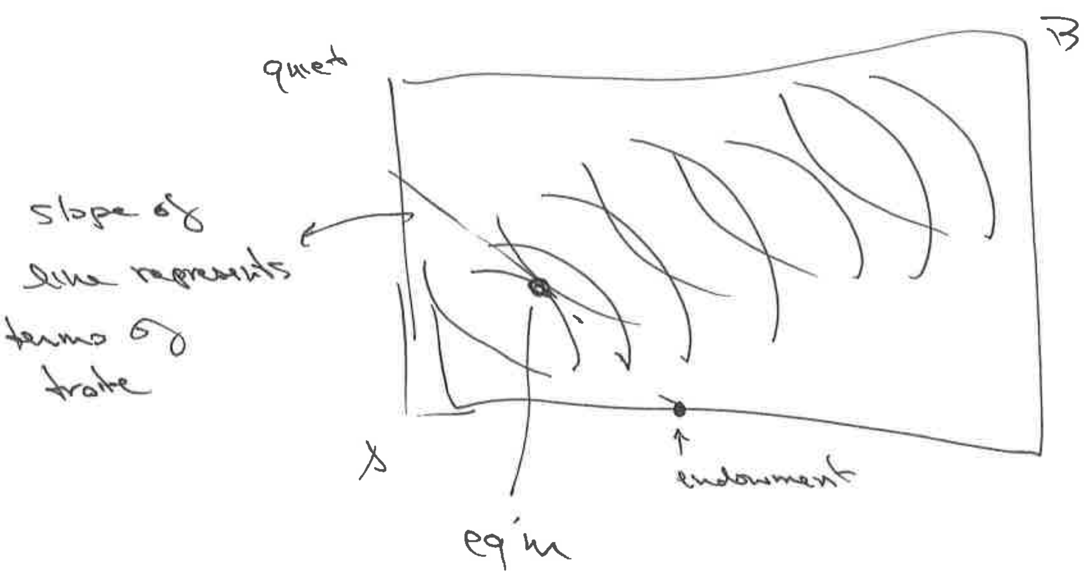
Edgeworth Box Diagram

- equilibria come where indiff curves are tangent.
  - this is where gains from trade are exhausted
- where these equilibria are located depends on what each roommate is endowed with

→ consider where both are endowed w/ $100 and roommate A is endowed w/ the right to have quiet!



→ Now consider where both have $100 and B is endowed w/ right to play music at any hour:



→ either way we have an eq'm
→ either way the eq'm is pareto optimal
→ But distribution of outcome very different - depends on endowment

→ But main point – if can trade $ for quiet – no efficiency lost from externality

⟹ Key: externalities are only a problem if there is no market for the externality

The Coase Theorem

→ If can trade in externality and transactions costs are low, then bargaining leads to a Pareto efficient outcome regardless of the initial allocation of property rights.

→ This is what we saw w/ the roommate example

→ highlights importance of defining property rights

→ Coase's work has been extremely influential in law and economics field

Production externalities

e.g.
→ 2 producers, one who creates an externality

steel manufacturer / polluter

$$\max_{s,x} \; p_s s - c_s(s,x)$$

fishery ~~profit~~

$$\max_{f} \; p_f f - c_f(f,x)$$

↑ affected by pollution, but can't determine/choose pollution

FOC's for steel producer:

$$p_s = \frac{\partial c_s(s,x)}{\partial s}$$

$$0 = \frac{\partial c_s(s,x)}{\partial x}$$

→ price for pollution is zero so produce a lot of it

FOC for fishery:

$$p_f = \frac{\partial c_f(f,x)}{\partial f}$$

→ production of steel/fish impose private costs on each firm

→ production of steel has an additional social cost – the cost to the fishery of producing steel

→ If the steel producer and fishery became one company, they would internalize this social cost. The joint company's profit max would be:

$$\max_{s,f,x} \; p_s s + p_f f - c_s(s,x) - c_f(f,x)$$

FOCs:

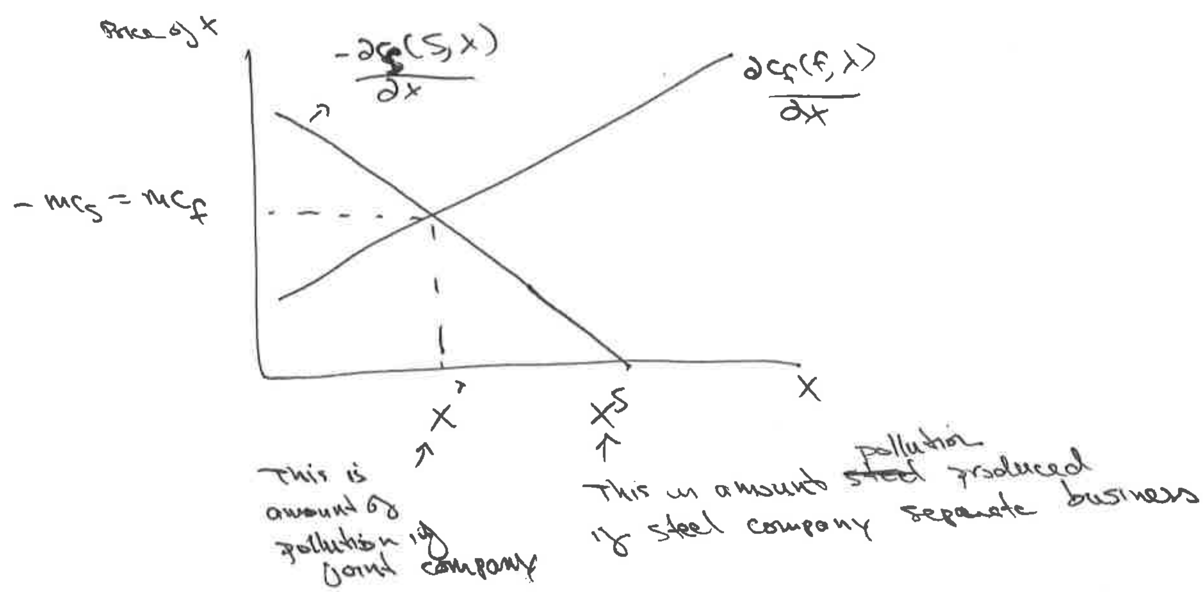
$$p_s = \frac{\partial c_s(s,x)}{\partial s}$$

$$p_f = \frac{\partial c_f(f,x)}{\partial f}$$

$$-\frac{\partial c_s(s,x)}{\partial x} = \frac{\partial c_f(f,x)}{\partial x}$$

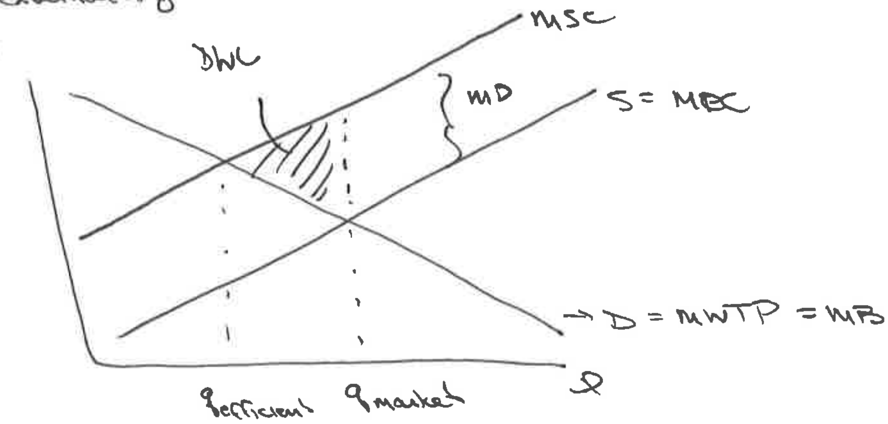
now account for how pollution affects both steel and fish production
→ the x that solves this is the optimal x

Graphically:



Externalities and Market Efficiency

Negative externality:



MPC = marginal private cost

MSC = marginal social cost

MD = marginal external damage

$$MSC = MPC + MD$$

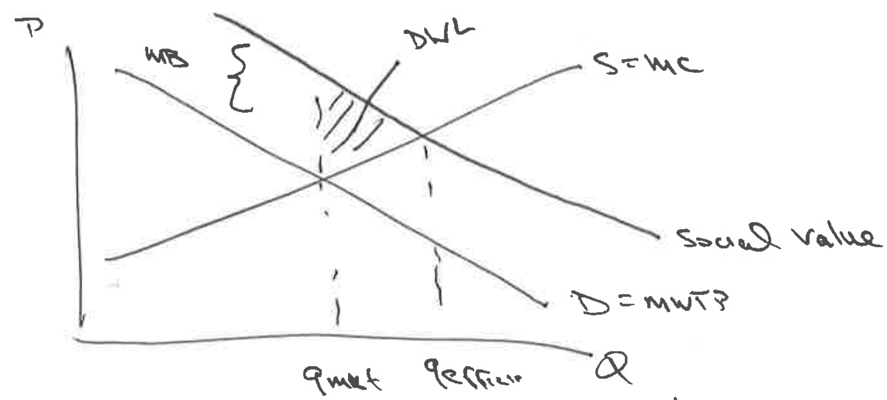
MP

→ The market only takes into account the private costs/benefits

⇒ it overproduces negative externalities

⇒ it underproduces positive externalities

e.g. positive externalities



MB = marginal external benefits

How do we solve the market failure that results in externalities?

(1) Define property rights more clearly (Coasian Solution)

e.g. assume fishery has right to clean water and that steel mill would need to pay fishery to pollute

→ let q be the price per unit of pollution

steel mill's problem:

$$\max_{s,x} \; p_s s - \underbrace{qx}_{\text{pay for pollution}} - c_s(s,x)$$

FOC's

(1) $p_s = \frac{\partial c_s(s,x)}{\partial s}$

(2) $-q = \frac{\partial c_s(s,x)}{\partial x}$

fishery's problem:

$$\max_{f,x} \; p_f f + \underbrace{qx}_{\text{rev from selling pollution}} - c_f(f,x)$$

FOC's

(3) $p_f = \frac{\partial c_f(f,x)}{\partial f}$

(4) $q = \frac{\partial c_f(f,x)}{\partial x}$

(2) & (4) ⇒ $-\frac{\partial c_s(s,x)}{\partial x} = q = \frac{\partial c_f(f,x)}{\partial x}$

→ optimal amount of x

→ note, could define ~~$~~ right to pollute w/ steel mill and have fishery pay for clean water

(2) → check that this yields <u>same</u> outcome

(2) Tax the pollution

→ we call a tax used to correct an externality a <u>Pigouvian</u> tax

Steel mill's problem:

$$\max_{s,x} \; p_s s - c_s(s,x) - t x$$

↑ tax per unit of x

FOCs:

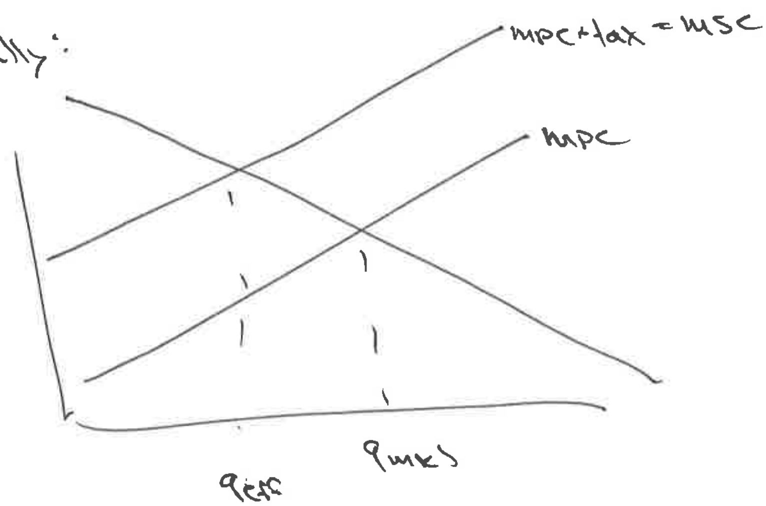
$$p_s = \frac{\partial c_s(s,x)}{\partial s}$$

$$t = -\frac{\partial c_s(s,x)}{\partial x}$$

$\Rightarrow$ if set $t = \frac{\partial c_f(f,x)}{\partial x}$ = marginal external damage

then get optimal pollution

Graphically:



↓ tax gets you here

(3) quota

→ could reduce all firm's ~~allows~~ pollution by same amt

→ but this isn't cost effective

→ consider prob: want to reduce pollution across 2 firms by X

→ cost of reducing pollution by x_1 for firm 1 is given by $c_1(x_1)$

→ cost of reducing pollution by x_2 for firm 2 is given by $c_2(x_2)$

$$\min_{x_1, x_2} c_1(x_1) + c_2(x_2)$$
$$\text{s.t. } x_1 + x_2 = X$$

FOCs:

$$\frac{\partial c_1(x_1)}{\partial x_1} = \lambda$$

$$\frac{\partial c_2(x_2)}{\partial x_2} = \lambda$$

$$\Rightarrow \frac{\partial c_1(x_1)}{\partial x_1} = \frac{\partial c_2(x_2)}{\partial x_2}$$

equalize marginal costs of pollution abatement is most cost effective

→ so if $c_1 \neq c_2$ then don't want $x_1 = x_2$

→ How get this efficient outcome?

→ cap and trade

→ auction off or give away permits allowing X amt of pollution

→ then let firms trade permits

→ outcome will look like sol'n (1)

Market Signals

→ An important point - the market encourages firms to internalize externalities

→ They often do this → e.g. beekeeper and apple orchard,

→ consider the problem of the fishery and steel mill → profits higher together than separate

⇒ gives incentive to merge to internalize costs

→ Limit → this only works well for local, ~~[illegible]~~ externalities

The Tragedy of the Commons

→ The tragedy of the commons is a well known result of a production ~~others~~ or consumption externality

→ it happens when there is a common pool resource - one that all share equally

→ In this case, no one takes into account their use ~~of~~ on the value to others and the resource gets over used.

→ Classic example (and where name comes from) is from the problem of grazing cows on the common land.

→ The ~~entire village's~~ problem to determine optimal # of cows:

$$\max_c f(c) - ac$$

→ a = price of cow

→ c = # cows

FOC:

$$\frac{\partial f(c)}{\partial c} = a \quad \rightarrow MC = \text{price}$$

→ Each villager's problem

if current output is $f(c)$, then per cow gets $\frac{f(c)}{c}$.

→ Add one more cow and it gives: $\frac{f(c+1)}{c+1}$

→ Add another cow if $\frac{f(c+1)}{c+1} > a$

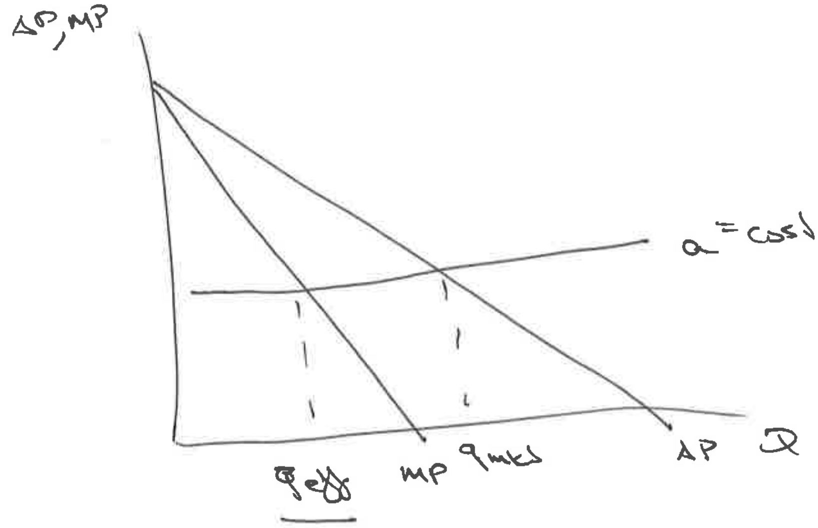
avg product > price

→ profits driven to zero: $\frac{f(c)}{c} = a \Rightarrow \frac{f(c)}{c} - a = 0$

$$\Rightarrow f(c) - ac = 0$$

⇒ if avg prod > marg prod ⇒ too many cows

Graphically:



MP < AP b/c AP declining (so marginal must lie below the avg)

→ many examples of this:

→ congestion on public roads

→ fish stocks

→ groundwater in dry locations (eg Southern CA)

→ Air pollution

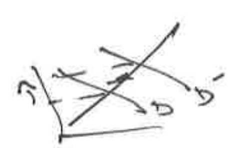
etc.

Pecuniary externalities

→ There are some externalities that produce external costs and benefits that offset exactly

→ we call these pecuniary externalities

→ e.g. your demand for Coke ↑ price



→ this is an external cost on other consumers

→ but that ↑ price is an external benefit to coke producers

→ the size of these 2, then Δ in price, exactly are equal