Externalities

1) Producer - Producer

Paper mill, upstream from fish hatchery. (negative)

Apple-orchard and bee-keeper (positive)

2) Producer-consumer

Factory producing smoke, people inhale it. (negative)

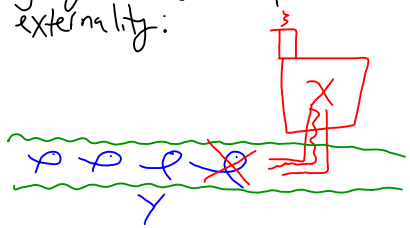
3) Consumer - Consumer

Second-hand smoke (negative)

Inoculation against disease, esp. in high density areas (positive).

- Individuals reducing standing water, swamp land, on private property. (positive)
- Smoke alarms, fireproofing, alert neighbours or reduce fires that spread (positive).

Interdependence in production giving a negative producer-producer externality:



Economy

$U^1(x_1, y_1)$ $\quad x = \text{paper}$

$y = \text{fish}$

$U^2(x_2, y_2)$

$g(L_x, K_x)$, produce paper and S, proportional to x.

$f(L_y, K_y, S)$, produce fish

$S \to$ sludge

$\frac{\partial f}{\partial S} < 0$

Different structure to the economy than in the benchmark economy.

Whether equilibria are efficient or not depends on many things ("institutions").

Suppose one person owned both factories.

externality

$$\Rightarrow \max_{x,y} \; p_x x + p_y y - TC_x(x) - TC_y(x, y)$$

"True" marginal cost of x.

$$\Rightarrow \begin{cases} p_x - MC_x - \frac{\partial TC_y}{\partial x} = 0 \\ p_y - MC_y = 0 \end{cases}$$

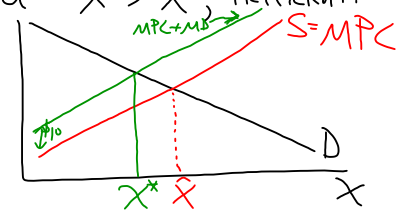
$\Rightarrow$ Expect efficient allocations to result. $\Rightarrow x^*$

Suppose separate owners.

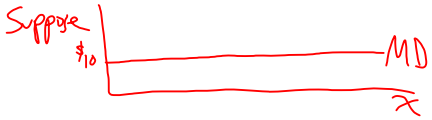
Paper mill: $\max_{x} \; p_x x - TC_x(x)$

$\Rightarrow p_x = MC_x(x) \Rightarrow \hat{x}$

Expect $\hat{x} > x^*$, inefficient.



Suppose



MD: marginal external cost or marginal damage, value of fish killed from producing extra unit of x.

Pigovian Tax: MD at x^*, i.e., at the level of output that takes into account the MD curve.

(Take MD curve, add it to MPC curve, find intersection with D curve $\Rightarrow x^*$ and the specific Pigovian tax.)

Charge polluter this, per unit of x:

A number.

$$\max_{x} \; p_x x - TC_x(x) - x \cdot MD(x^*)$$

$$\max_{x} \; P_x \cdot x - TC_x(x) - x \cdot MD(x^*)$$

$$\Rightarrow P_x - MC_x(x) - MD(x^*) = 0$$

Solution is $x = x^*$.

<u>Alternative:</u> Pigovian subsidy

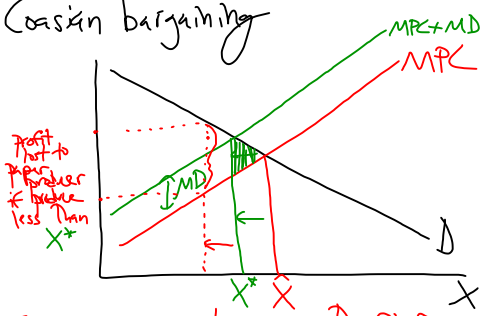
$$\max_{x} \; P_x \cdot x - TC_x(x) + \underbrace{(\hat{x} - x)}_{\text{constant}} \cdot MD(x^*)$$

$$\Rightarrow P_x - MC_x(x) - MD(x^*) = 0$$

Solution is $x = x^*$

(Money has to come from somewhere for the subsidy, though.)

Coasian bargaining



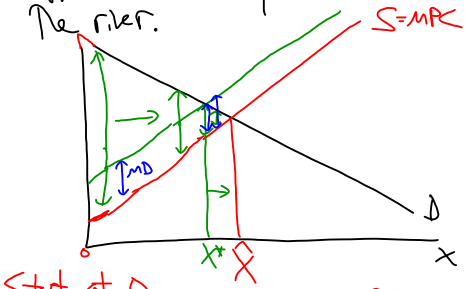
Suppose paper producer owns the river. We start at $\hat{x}$.

Fish producer is willing to pay at most MD to have one unit less of x produced.

Paper producer should recognize that her profit on the last unit of paper produced, the $\hat{x}^{th}$ unit, is zero. Should be willing to accept anything for it.

As output falls from $\bar{X}$ to X^*, most the fish producer will pay remains MD, but least the paper producer will accept rises from 0, until, at X^*, the profit to the paper producer is exactly MD on the X^{*th} unit.

Suppose the fish producer owns the river.



Start at 0.
Can make big profit producing the first unit.
(1). ⇒ Most they would pay the fish producer for the right to pollute.

Least the fish producer will accept is MD. Much less.

To the right of X^*, you have

$\updownarrow$MD > $\updownarrow$ = most paper producer will pay to produce that unit, the profit on that unit.

Most paper producer will pay is less than the least the fish producer will accept.

In its pure form, impractical.

Opposite extreme, "command and control" regulation.

Stipulate specific pollution control devices on all polluters, regardless of anything else (whether there are fish, whether other ways to reduce pollution exist, etc.)

If you can verify whether a factory is polluting or not, can require permits for polluting, with # permits consistent with an environmental quality standard.