Externalities

- Consumption Externalities
- Production Externalities

Consumption Externalities

- Occurs when one consumer cares directly about another consumer's consumption or a firm's production.
- Negative consumption externalities: smokers, automobile pollution.
- Positive consumption externality: neighbor's flowers.

Production Externalities

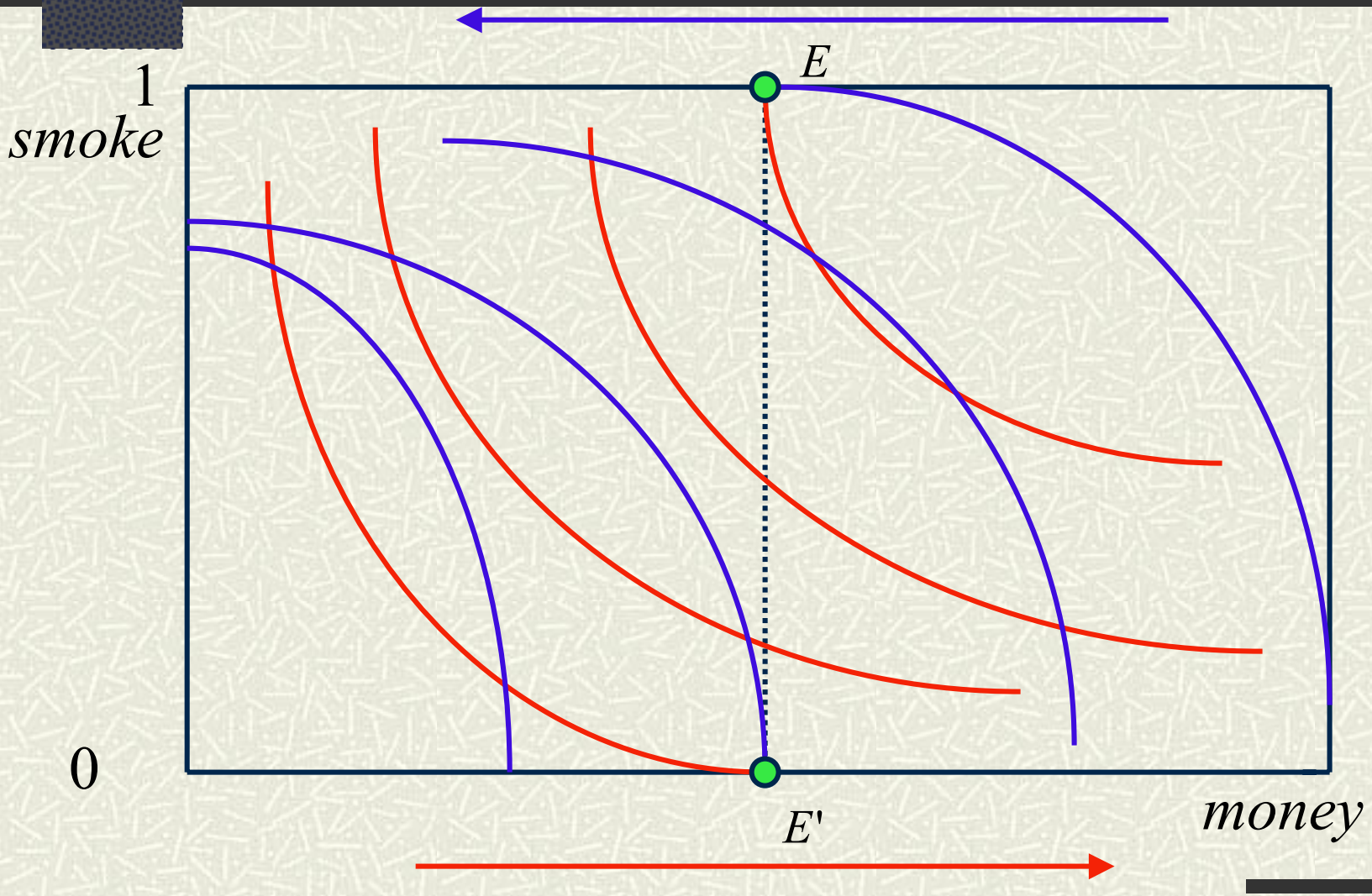
- Production possibilities of one firm are influenced by choices of another firm or consumer.
- Negative production externality: fishery cares about pollutants dumped by upstream firm.
- Positive production externality: R&D of one firm has positive effects on R&D of other firms.

Crucial Feature of Externalities

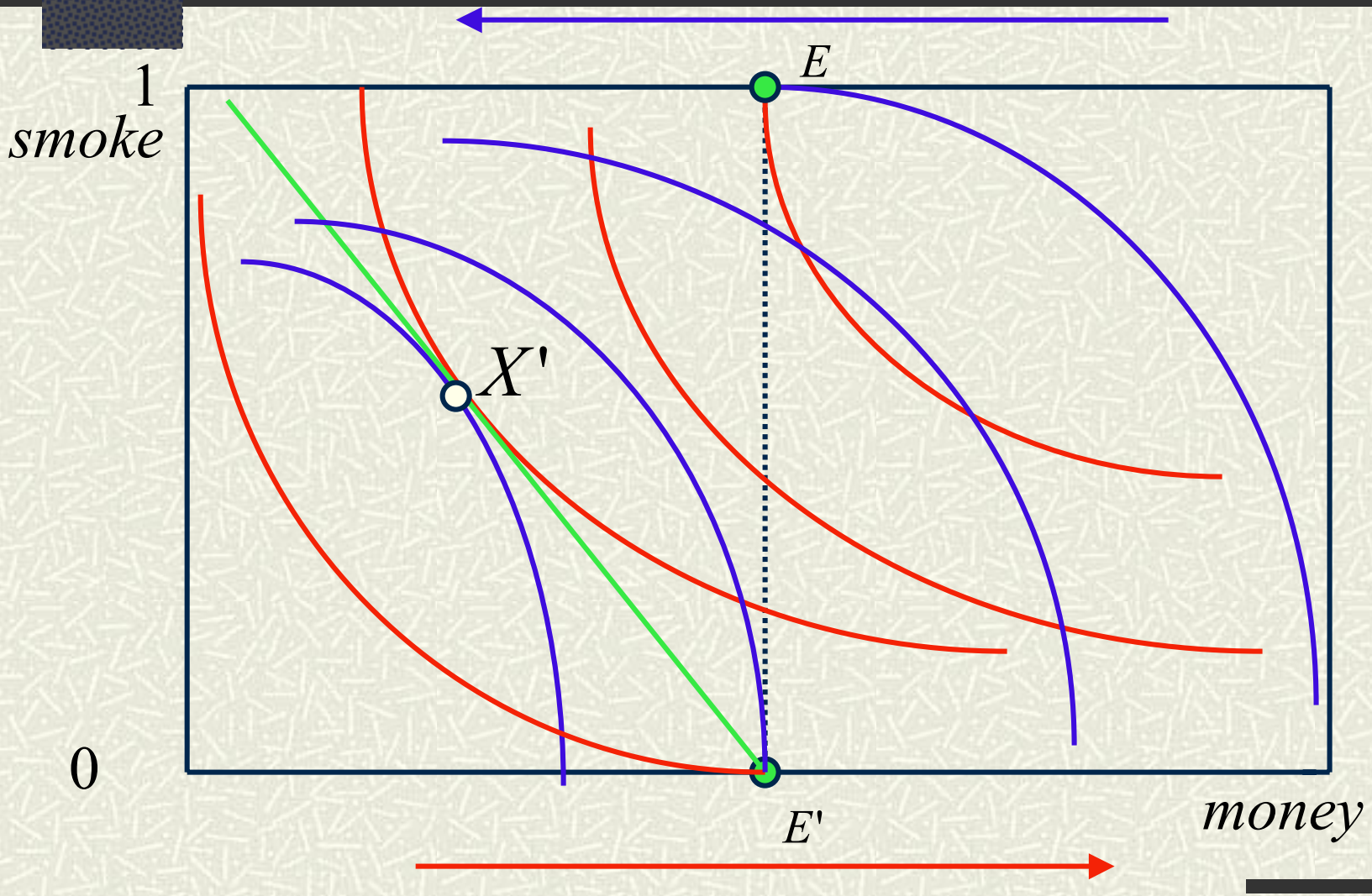
- There are goods people care about that are **not** sold on markets: no market for automobile pollution, pollutants, etc.

- Absence of markets implies equilibrium when there are externalities is **inefficient**: too much negative externalities, not enough positive ones.

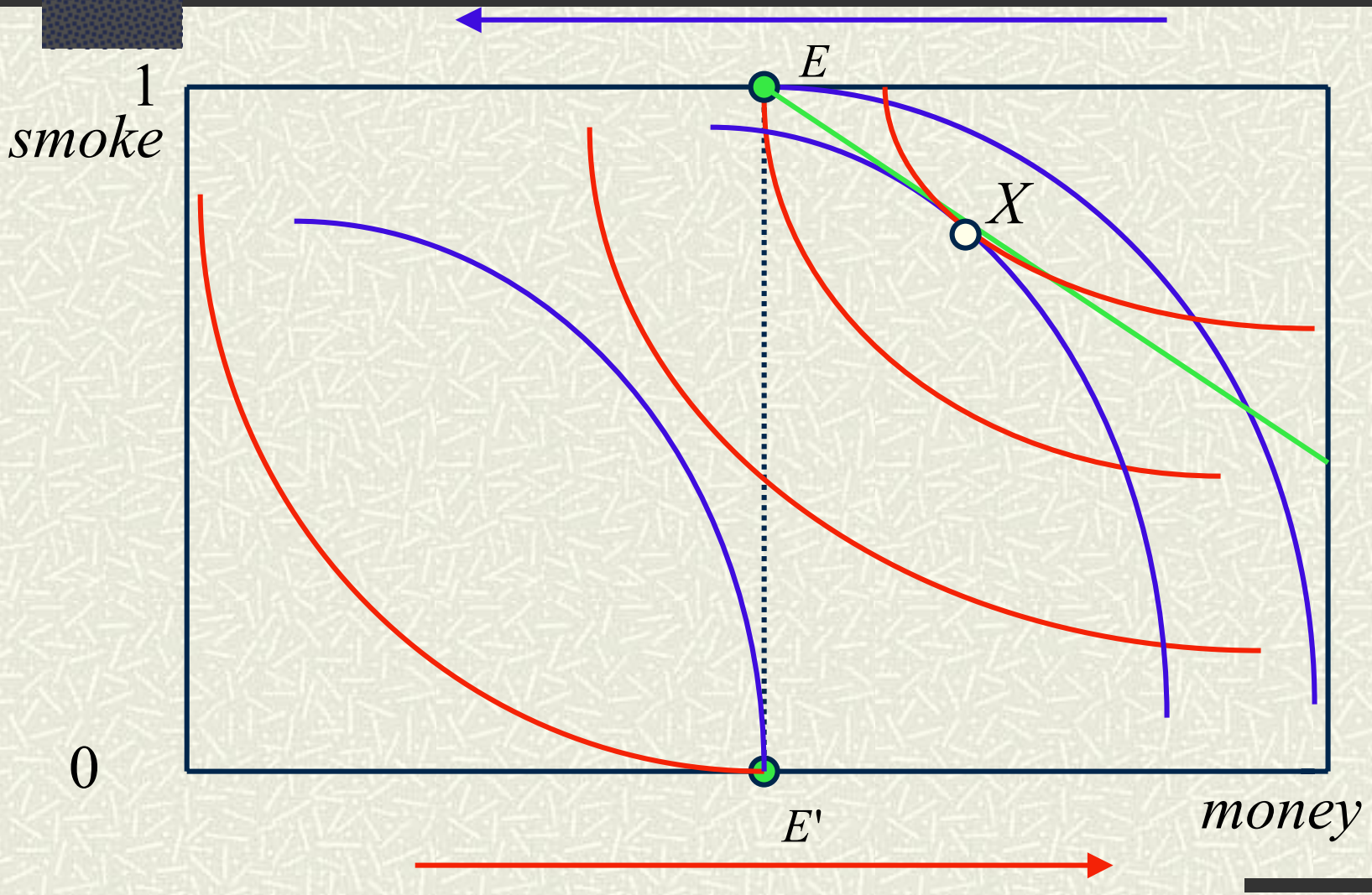
Example: Smoking



Example: Smoking



Example: Smoking



Example: Smoking

At an efficient equilibrium we have:

$$MRS_A(money, smoke) = MRS_B(money, smoke)$$

Example: Smoking

- Introducing a market for smoke improves the utility of both consumers.
- Problem with setting up such market: poorly defined property rights.

Example: Smoking

- Q: If a market for smoke can be organized, how much smoke will be produced?

- A: In general, it depends on the initial distribution of property rights.

Example: Production Externalities

- Firm S produces:

1. steel s;
2. pollution x, which is dumped into a river.

- Firm F, a fishery, is located downstream and is adversely affected by S's pollution.

Example: Production Externalities

- Cost function for S:

$$c_s\left(\underset{+}{s},\underset{+}{x}\right)$$

- Cost function for F:

$$c_f\left(\underset{+}{f},\underset{+}{x}\right)$$

Example: Production Externalities

- Profit maximization for S:

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

- Profit maximization for F:

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

Example: Production Externalities

Optimal choices for S:

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

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

Example: Production Externalities

Optimal choice for F:

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

Example: Production Externalities

- When setting optimal quantity of pollution, the steel firm does not take into account the cost of pollution for the fishery.

- **Social cost** of steel production: increase in the cost of fishing associated with an increase in pollution.

Example: Production Externalities

- What does a Pareto efficient production plan for steel and fish look like?

- Suppose the two firms merged:

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

Example: Production Externalities

Optimal choice of f,s,x:

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

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

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

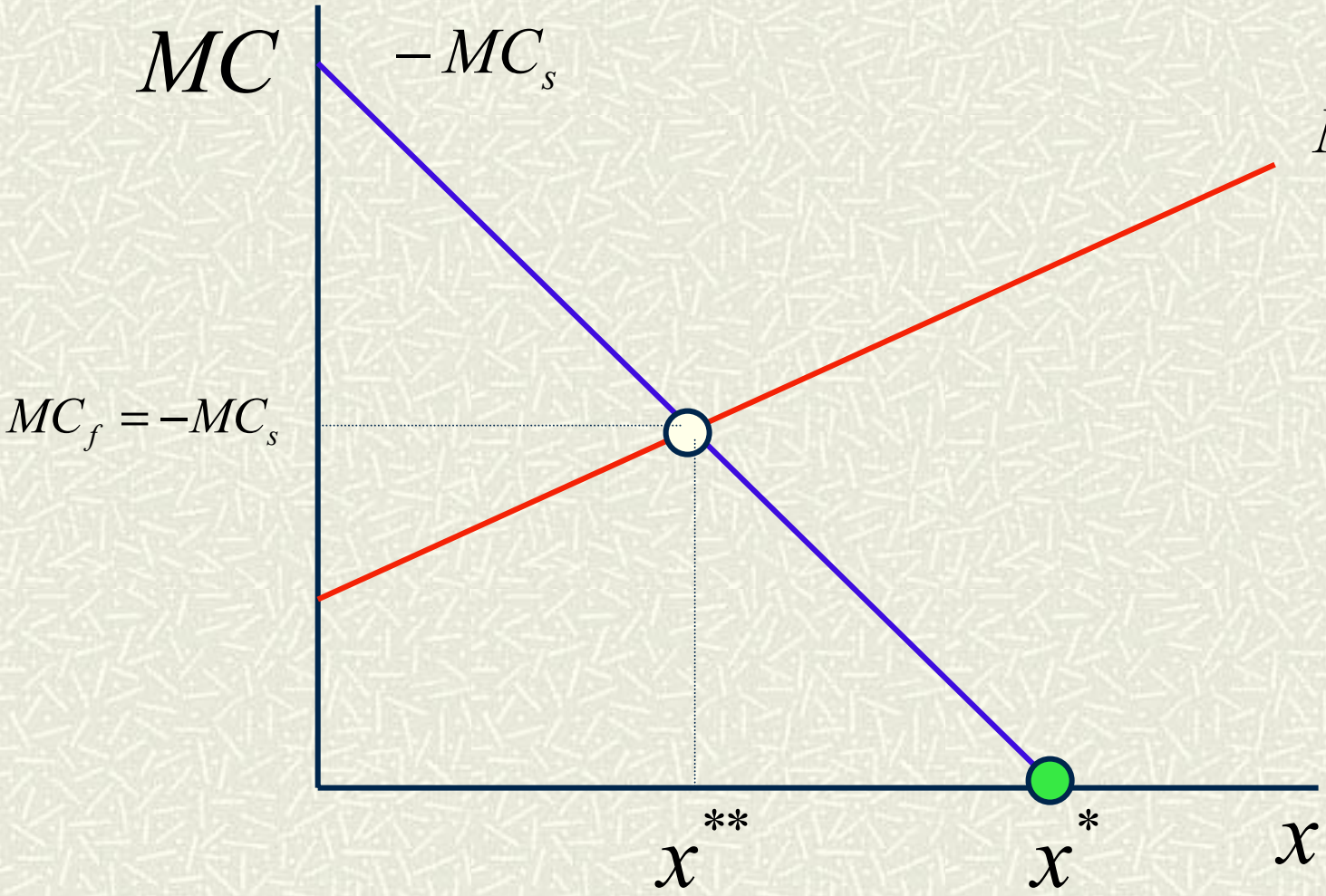
Example: Production Externalities

Compare pollution produced by merged firm pollution produced by steel firm:

$$-\frac{\partial c_s\left(s^{**},x^{**}\right)}{\partial x}=\frac{\partial c_f\left(f^{**},x^{**}\right)}{\partial f}>0$$

$$-\frac{\partial c_s\left(s^{*},x^{*}\right)}{\partial x}=0$$

Example: Production Externalities



Example: Production Externalities

- At the Pareto efficient level of production, the profits of the **merged firm** are larger than the sum of the profits of the two firms.

- How can the Pareto efficient outcome be achieved?

Internalizing Production Externalities: Taxation

- Steel firm faces the **wrong price** for pollution, i.e., zero.

- To correct this, impose a quantity tax t on pollutants:

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

Internalizing Production Externalities: Taxation

- Optimal choice of pollution with tax:

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

- Optimal choice of t:

$$t^* = \frac{\partial c_f\left(f^{**}, x^{**}\right)}{\partial x}$$

Internalizing Production Externalities: Create Market

- Missing market.
- Create market by assigning fishery the right to clean water. Fishery can sell right to steel firm.
- Or, create market by assigning steel firm the right to pollute water. Steel firm can sell right to fishery.

Internalizing Production Externalities: Create Market

- The amount of pollution does not depend on how property rights are distributed (different from consumption externalities).
- Distribution of property rights affects firms' profits.

Production Externalities: Incentives Are Already There

- Steel firm and fishery have an incentive to merge (higher profits): why don't they merge?!

- Or, somebody could buy both firms, merge them, and then enjoy higher profits.