Public Economics (ECON 131)
Section #3: Externalities

September 15 to 20, 2016

Contents

Page

---

1 Externalities

1.1 Key concepts

- **Externality:** Externalities arise whenever the actions of one party make another party worse or better off, yet the first party neither bears the costs nor receives the benefits of doing so.
- **Market failure:** A problem that causes the market economy to deliver an outcome that does not maximize efficiency.
- Private vs. social marginal cost and private vs. social marginal benefit
  - Graphical analysis of externalities
  - Understand which curve will shift and in what direction under different type of externalities
- Production vs consumption externalities
- **Internalizing an externality:** When either private negotiations or government action lead the price to the party to fully reflect the external costs or benefits of that party's actions.
- Coase Theorem (Part I and II)

1.2 Practice problems

1.2.1 Gruber Ch.05, Q.13

Suppose that demand for a product is $Q = 1,200 - 4P$ and supply is $Q = -200 + 2P$. Furthermore, suppose that the marginal external damage of this product is \$8 per unit.

(a) How many more units of this product will the free market produce than is socially optimal?

(b) Calculate the deadweight loss associated with the externality.

Solution:

(a) To answer this question, first calculate what the free market would do by setting demand equal to supply:

$$1,200 - 4P = -200 + 2P \qquad \text{or} \qquad 1,400 = 6P.$$

Thus, $P_{FM} \approx 233.33$ and $Q_{FM} = 1,200 - 4(233.33) \approx 266.67$.

The socially optimal level occurs when the marginal external cost is included in the calculation. I will list a two different (but equivalent) ways to solve this problem:

i) Externality price added to consumers:
Suppose the \$8 externality were added to the price each consumer had to pay (as if there were a tax on consumers). Then, the consumer pays \$8 more than the producer receives, so $P^D = P^S + 8$, where P^D is the price that consumers pay, and P^S is the price that producers receive.
Then demand would be $Q^D = 1,200 - 4P^D = 1,200 - 4(P^S + 8)$. Supply is still $Q^S = -200 + 2P^S$.
Solving for P^S and Q by setting demand equal to supply:

$$1,200 - 4(P^S + 8) = -200 + 2P^S$$

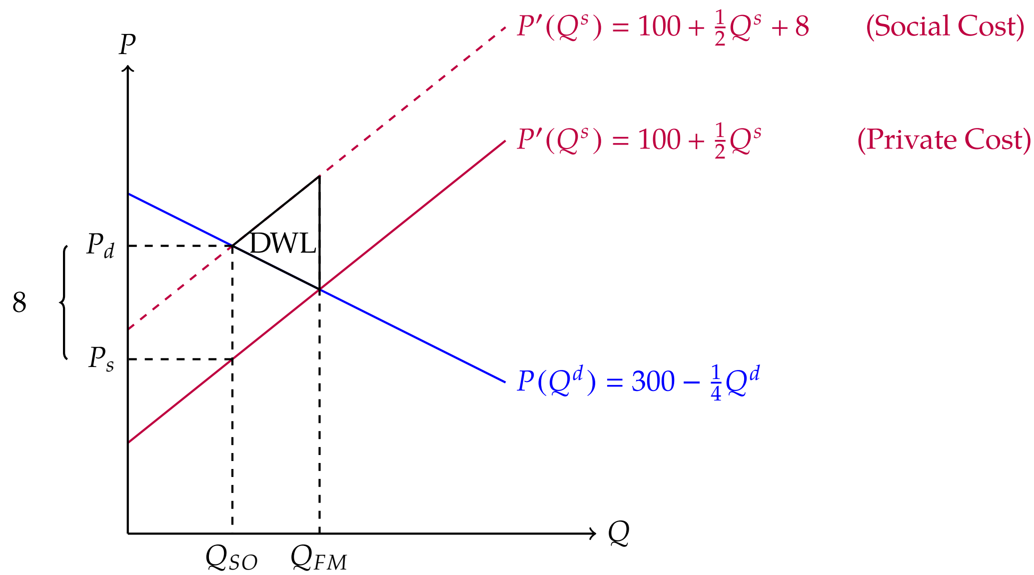
Thus, $P^S_{SO} = 228$. To find Q_{SO}, plug this price back into the supply curve (since we are plugging in the "supply" price) to get $Q_{SO} = 256$.

ii) Externality price added to producers:
Supppose the \$8 externality were subracted from the price each producer received (as if there were a tax on producers). Then, the producer receives \$8 less than the consumer pays, so $P^S = P^D - 8$.
Then, supply would be $Q^S = -200 + 2P^S = -200 + 2(P^D - 8)$ and demand would still be $Q^D = 1,200 - 4P^D$.
Solving for P^D and Q by setting demand equal to supply:

$$-200 + 2(P^D - 8) = 1,200 - 4P^D$$

Thus, $P^D_{SO} = 236$. Plugging the price back into the demand curve (since we are plugging in the "demand" price), we get $Q_{SO} = 256$.

Note that either solution gives $Q_{SO} = 256$. This means that the free market will produce $10\frac{2}{3}$ units more than is socially optimal. All of the results are also listed in the graph below.



(b) Deadweight loss is the area of the triangle labelled on the graph. The height of the triangle is 8 (the amount of the tax) and width $10\frac{2}{3}$ $(Q_{FM} - Q_{SO})$: $\frac{1}{2}(8 \times 10\frac{2}{3}) \approx 42.67$.

1.2.2 Gruber Ch.05, Q.14

The marginal damage averted from pollution cleanup is $MD = 200 - 5Q$. The marginal cost associated with pollution cleanup is $MC = 10 + Q$.

(a) What is the optimal level of pollution reduction?

(b) Show that this level of pollution reduction could be accomplished through taxation. What tax per unit would generate the optimal amount of pollution reduction?

Solution:

(a) Damage averted is the benefit, so solve by setting damage averted equal to the marginal cost:

$$200 - 5Q = 10 + Q \qquad \text{or} \qquad Q = 31\frac{2}{3}$$

(b) By setting a tax T on each unit of pollution, the government will induce the polluters to clean it up as long as the marginal cost of cleanup is less than or equal to the tax.

So the total amount of pollution cleanup for a given tax will solve:

$$10 + Q^* = T$$

To implement the social optimum of $31\frac{2}{3}$ units of pollution thus requires a tax of $10 + 31\frac{2}{3} = 41\frac{2}{3}$.

1.2.3 Gruber Ch.05, Q.4

In the midwestern United States, where winds tend to blow from west to east, states tend to more easily approve new polluting industries near their eastern borders than in other parts of the state. Why do you think this is true?

Solution:

- When a state approves new polluting industries, it imposes an externality on neighboring "downwind" states.
- It is unlikely that downwind states have figured out a way to make upwind states fully internalize their externalities. States are therefore unlikely to fully take into account the costs they impose on other states by locating their polluting plants near their eastern borders.
- On the other hand, they will tend to take into account the pollution costs they would impose on themselves by locating their plants farther west. Hence, the private cost of installing plants in the eastern part of the states will tend to be smaller than the private cost of installing plants in the western part, and they are therefore more likely to approve new polluting industries near their eastern borders.
- Of course, there may be other, more important reasons for them to locate their polluting industries on the eastern border of their state. Possibly because of patterns of settlement (east to west), large cities in midwestern states tend to be located on the eastern borders of their states; examples include Detroit, Chicago, Milwaukee, and the Twin Cities. It may be that industrial plants tend to be located near such population (employment) centers.