Handout 14

1 Topics

- Externalities
- Tax Incidence
- Public goods

2 Review

2.1 Externalities

- Externalities are imposed costs or bestowed benefits to a third party as a result of actions or decisions from some actors.
- Negative externalities lead to marginal social cost (MSC) being higher than marginal private cost (MPC).
- Positive externalities lead to marginal social benefit(MSB) being higher than marginal private benefit (MPB).
- Without externalities, $MSC = MPC$ and $MSB = MPB$.
- Market equilibrium is where $MPC = MPB$ and social optimum is where $MSC = MSB$.
- We can introduce taxes in cases of negative externalities and subsidies in case of positive externalities to ensure that market equilibrium matches with social optimum.

2.2 Tax Incidence

- Taxes introduce a wedge between price that consumers pay and price that the suppliers get. As such, $P_P < P_C$.
- To solve for equilibrium, we can solve for $Q_D = Q_S = Q$. Moreover, tax revenue $= (P_C - P_P) \times Q$.
- Taxes generally create deadweight loss. In special cases of perfectly inelastic supply or a perfectly inelastic demand, there is no deadweight loss.
- Please refer to Prof. Hansen's notes for detailed discussion on tax incidence and deadweight loss.

2.3 Public Goods

- Public Goods are *nonrival* in consumption and their benefits are *nonexcludable*.
- *Nonrival*: A person consuming the good does not prevent someone else from doing so too.
- *Nonexcludable*: Once a good is produced, no one can be excluded from enjoying its benefits.
- Solution Concept: People have different demand for public goods. These demands describe their individual willingness to pay. Hence, for each quantity of public good, you can get the society's willingness to pay by adding up each individual willingness to pay. Graphically, this is equivalent to taking a **vertical sum** of individual demands to get an aggregate demand for the public good. *This is in contrast to the private goods case where you take horizontal sums to get aggregate demand.*
- Solution Method: Hence, given individual demands, you get individual P in terms of Q. You add the individual Ps to get an aggregate P that depends on quantity Q. **Note** that for certain values of Q, not all individuals may have a positive willingness to pay. So, you will likely get a piece-wise function for aggregate demand.

3 Exercises

Externalities

1. Sriracha hot sauce is supplied according to $P = 3 + \frac{1}{4}Q$. Demand for sriracha is $P = 7 - \frac{1}{4}Q$.

   (a) What is the market quantity and price?

   (b) The production of sriracha also produces noxious fumes that irritate residents that live near the sriracha plant in Irwindale, California (this is real; there have been several lawsuits). Suppose that these fumes represent a negative production externality of \$2 per unit. What is the marginal social cost (MSC) of a unit of sriracha?

(c) What is the socially optimal quantity and the deadweight loss of the market equilibrium?

(d) What policy could the Irwindale city council use to achieve the optimal quantity of Sriracha?

Tax Incidence

2. Suppose demand is given by $P = 200 - Q$ and supply is $P = Q$.

   (a) What is the competitive equilibrium price and quantity?

(b) Suppose the government now imposes a $20 tax on consumers. What quantity will be traded?

(c) What price will consumers pay? What price will producers receive?

(d) How much tax revenue does the tax raise?

(e) Who bears the economic burden of the tax?

(f) Is there any deadweight loss?

(g) What would change if supply was perfectly inelastic, i.e. just $Q = 100$?

Public Goods

3. What are the two characteristics of public goods that distinguish them from private goods?

4. Alice, Bob and Charlie are looking forward to the end of semester: they are getting tired of appearing in so many questions. To celebrate they plan to have a fireworks display after the final exam. Their individual demand curves for fireworks are:

$$\text{Alice:} \quad P = 5 - \frac{1}{4}Q$$

$$\text{Bob:} \quad P = 10 - \frac{1}{2}Q$$

$$\text{Charlie:} \quad P = 20 - Q$$

Suppose fireworks cost \$14 each.

(a) Draw the individual demand curves separately. If Alice, Bob and Charlie each have their own separate fireworks displays, how many fireworks will each of them buy?

(b) Now vertically sum the three demand curves to form a market demand curve. What key feature of public goods makes vertical summation appropriate (instead of the horizontal summation we have been doing all semester?).

(c) What is the optimal quantity of fireworks that Alice, Bob and Charlie should buy together?

(d) How much should Alice, Bob and Charlie contribute per-firework to ensure the optimal quantity of fireworks is purchased?

5. (Questions 108-109 from Review Questions with extra question added) Andrew, Bob and Christian live on Short Street outside Madison. They decided to build a small public garden at the corner of the street right by the lake. They each have a different demand curve for the garden given by the following equations:

   Andrew: $P_A = 60 - Q$
   Bob: $P_B = 60 - 2Q$
   Christian: $P_C = 30 - 3Q$

   The marginal cost of building the garden is given by MC = 2Q where Q represents the area in terms of square feet that will be allocated to the garden.

   (a) Find the aggregate demand.

   (b) What is the optimal area to be allocated for this public garden?

   (c) How much each person is going to pay?