AAE 343 Discussion Section 2

February 1, 2019

I. Supply and Demand Quick Review

- Demand equation: $Q_d(P) = \alpha - \beta P$
- Inverse demand equation: $P(Q_d) = \frac{\alpha}{\beta} - \frac{1}{\beta}Q_d$
- Supply equation: $Q_s(P) = \gamma P - \delta$
- Inverse supply equation $P(Q_s) = \frac{1}{\gamma}Q_s + \frac{\delta}{\gamma}$
- **Consumer surplus** ($\boldsymbol{CS}$): the difference between the Marginal Willingness to Pay and the price up to the amount consumed (i.e. the area between the price curve and the demand curve).
- **Producer surplus** ($\boldsymbol{PS}$): the difference between the price and the marginal cost up to the amount produced. (i.e. the area between the price curve and the supply curve).
- The demand curve represents the **marginal willingness to pay** ($\boldsymbol{MWTP}$) or the **marginal benefit** ($\boldsymbol{MB}$) of consumption. The supply curve represents the **marginal cost** ($\boldsymbol{MC}$).
- The **total net benefit** ($\boldsymbol{TNB}$), sometimes called the social net benefit ($\boldsymbol{SNB}$)**,** is the net benefit to all participants, both producers and consumers, in the market resulting from the trade of a relevant good. This can be determined through summing the producer surplus and the consumer surplus ($\boldsymbol{TNB = PS + CS}$) or by finding the difference between the total benefit and the total cost ($\boldsymbol{TNB = TB - TC}$).

Problem 1 *Growin' Garlic I* – Erica grows garlic in her backyard and sells it at the Madison Farmers' Market. Her marginal cost is $MC = Q_S$. Demand for garlic in Madison can be written as $P = 6 - Q_D$. Let the units for price be measured in US dollars and units for quantity be in bushels of garlic.

1. Draw a graph of the scenario. What is the optimal quantity and price?
2. Calculate the area of the following:
    a) Consumer surplus
    b) Producer surplus
    c) Total benefit
    d) Total cost
    e) Total net benefit

II. Production Externalities

- **Marginal private cost** (MPC) is the cost faced by the producer in production.
- **Marginal external cost** (MEC) is a cost caused by an action that is not transmitted via market prices.
- **Marginal social cost** (MSC) is the sum of MPC and MEC.
- Let's firm up the concepts of external and social costs by talking through a few examples:
    - Climate change and the social cost of carbon[1]
    - Transboundary water pollution[2]
    - Infectious disease[3]

Problem 2 *Growin' Garlic II* – Suppose the garlic growing in Erica's garden bothers her neighbors (vampires, I guess?). Specifically, they have a marginal external cost of $2 per bushel.

1. What is the marginal social cost?
2. Graph the problem. What is the socially optimal quantity and price?
3. At that optimal quantity and price, calculate following:
    a) Consumer Surplus
    b) Producer Surplus
    c) Loss on Producer and Consumer Surplus
    d) Total Net Loss under unregulated market outcome

[1] Auffhammer (2018), "Quantifying Economic Damages from Climate Change", *J. Econ. Perspectives*.
[2] Lipscomb and Mobarak (2016), "Decentralization and Pollution Spillovers: Evidence from the Re-drawing of County Borders in Brazil", *Rev. Econ. Studies*.
[3] Costello et al (2017), "Private eradication of mobile public bads", *Eur. Econ. Rev*.

III. Private Goods

- Private goods are **rival** and **excludable.**
- Demand curves for private goods are added horizontally.

Problem 3 *Ice cream with clones* – The individual demand for ice cream (WI-made of course!) by a group of identical clones is $P = 4 - 2Q$. Let the units for price be measured in USD and the units for ice cream be in scoops.

1. Write an equation for demand and graph the demand curve for the following:
    a) 1 clone
    b) 2 clones
    c) 4 clones
2. Suppose the supply curve is described by $MC = 2$. Add it to your graph from part 1.
3. What is the optimal price and quantity for one clone? For two clones? For four clones?

IV. Public Goods

- Public goods are **non-rival** and **non-excludable.**
- Demand curves for public goods are added vertically since all individuals enjoy the same levels of a good.

Question 1 What are the defining characteristics of open access goods? (answer graded)
Question 2 Which of the listed goods is closest to a pure public good? (answer graded)

Problem 4 *Asthmatic clones* – Demand for the government to provide particulate-free air is important to ice cream eating clones. An individual clone's WTP for clean air can be expressed $P = 4 - 2Q$. Let the units for price be measured in USD each clone would be willing to pay each day and let the units for Q be reduction of particulate matter, measured as micrograms per m^3, over a 24-hour period.

1. Write an equation for demand and graph the demand curve for the following:
    a) 1 clone
    b) 2 clones
    c) 4 clones
2. Suppose the supply curve is described by MC = 2. Add it to your graph from part 1.
3. What is the optimal price and quantity for one clone? For two clones? For four clones?
4. What is the total benefit, cost and net benefit from the efficient equilibrium found in the four clone economy from part 3? Show this graphically.

Now assume that the government surveys the clone community and finds that no individual is interested in paying for a reduction in PM past one microgram per cubic meter (i.e., $Q_S = 1\,\mu g/m^3$).

5. What is the total benefit, cost and net benefit from this new government established equilibrium in our four clone economy? Show this graphically.
6. What is the total net loss from the government's decision to select a PM reduction level of $1\ \mu g/m^3$, as opposed to setting air quality at the efficient level found in part 4. Show this region graphically.