Discussion 3

1 Important Topics

- Determinants of demand and supply
- Movement along the demand (supply) curve versus a shift of the demand (supply) curve
- Aggregate individual demand (supply) curves to get market demand (supply) curve
- Market Equilibrium
- Price Floor, Price Ceiling
- Consumer Surplus (CS), Producer Surplus (PS), Deadweight Loss

2 Exercises

2.1 Determinants of demand.

Consider the case of Five Guys on State Street. They know that they face a downward sloping demand for regular cheeseburgers. The manager hires you to predict the following scenarios. Make a graph showing the changes described and identify which determinant of demand is invoked in each scenario.

- The reduction of the price in cheeseburgers leads to a downward movement along the demand curve of cheeseburgers. **Determinant: Change in price of the good.**
- A new campaign for weight loss successfully persuades people that cheeseburgers are very unhealthy, leading to a left shift of the demand curve of cheeseburgers. **Determinant: Change in preferences.**
- French fries are often purchased together with cheeseburgers, and the price of French fries decreases, resulting in a right shift of the demand of cheeseburgers. **Determinant: Change in the price of a complementary good.**
- The price of Wendy's cheeseburgers decreases. This leads to a a left shift of the demand curve of cheeseburgers. **Determinant: Change in the price of a substitutable good.**

2.2 Predict what happens to supply curve, demand curve, equilibrium price, and equilibrium quantity.

For each of the following markets, predict the change in price and quantity sold using a supply-and-demand graph: You should draw the curves to get to answers that are presented here.

- Predict the changes in the market for beef when chicken becomes cheaper.
  Demand decreases/shifts left due to decreases in price of substitute. Equilibrium price and quantity fall.

- Predict the changes in the market for coffee when cream becomes cheaper.
  Demand increases/shifts right as price of complement falls. Equilibrium price and quantity rise.

- Predict the changes in the market for automobiles when workers' unions successfully raises workers' wages by 20%.
  Supply decreases/shifts left because production costs increase. Equilibrium price rises, equilibrium quantity falls.

2.3 Aggregate supply and aggregate demand in the tutoring market.

Suppose Andy and Elise are supplying labor in the tutoring market. Joohyun and Hiro are potential buyers in this market.

Andy has the following supply curve: $P_a = 10Q_a$, where P_a is the hourly price Andy charges, and Q_a is the total hours that Andy supplies. Elise's labor supply curve is identical to Andy's: $P_e = 10Q_e$.

On the demand side, Joohyun has the following demand for tutoring hours: $P_j = 100 - \frac{1}{4}Q_j$, where P_j is the hourly price Joohyun pays, and Q_j is the total number of hours demanded by Joohyun. Hiro has the following demand: $P_h = 125 - \frac{1}{2}Q_h$.

1. Suppose Andy and Elise are the only tutors in this market. What is the aggregate market supply curve?

   Solution: Let's denote aggregate quantity supplied as Q_S.

   $$\begin{aligned} Q_S &= Q_a + Q_e \\ &= \frac{P}{10} + \frac{P}{10} \\ &= \frac{1}{5}P \end{aligned}$$

   Alternatively, you can write it as $P = 5Q_S$.

2. Suppose Hiro and Joohyun are the only buyers in this market. What is the aggregate market demand curve? Graph individual demand curves and market demand curve.

   Solution: Let's denote aggregate quantity supplied as Q_D. Transforming the given functions of inverse demand[1] into the demand:

   $$\text{Joohyun: } Q_j = \begin{cases} 0 \text{ , when } P > 100 \\ 400 - 4P \text{ , when } P \leq 100 \end{cases}$$

   $$\text{Hiro: } Q_h = \begin{cases} 0, \text{ when } P > 125 \\ 250 - 2P \text{ , when } P \leq 125 \end{cases}$$

[1] **Demand vs. Inverse Demand:** When P is on the left hand side alone, we call the function **inverse demand** (or inverse supply); when Q is on the left hand side alone, we call the function **demand** (or supply).

When P $\in [100, 125]$, only Hiro has positive quantitity demanded:

$$\begin{aligned} Q_D &= Q_h \\ &= 250 - 2P \end{aligned}$$

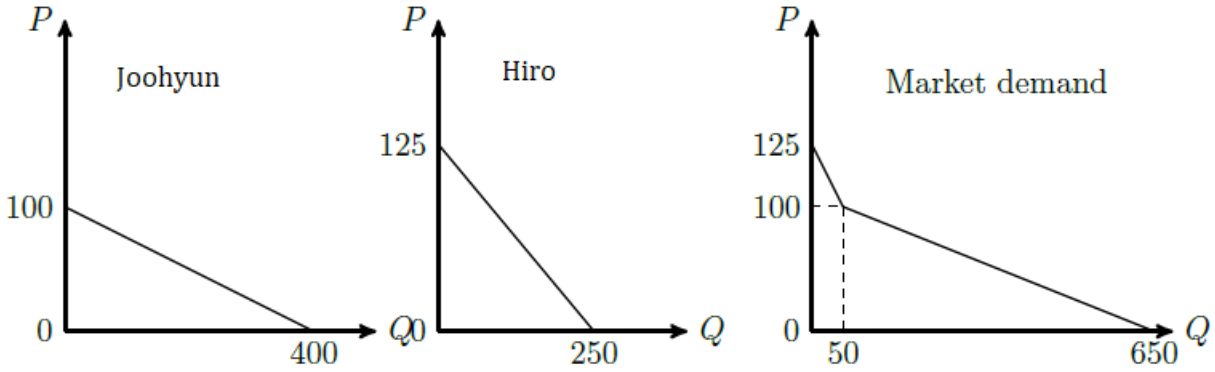
When P $\in [0, 100]$, both Hiro and Joohyun have positive quantity demanded:

$$\begin{aligned} Q_D &= Q_j + Q_h \\ &= (400 - 4P) + (250 - 2P) \\ &= 650 - 6P \end{aligned}$$

To summarize the aggregate demand function is:

$$Q_D = \begin{cases} 0 \text{ when } P > 125 \\ 250 - 2P \text{ when } 100 < P \leq 125 \\ 650 - 6P \text{ when } P \leq 100 \end{cases}$$

Table 1: Aggregate demand curve and individual demand curves



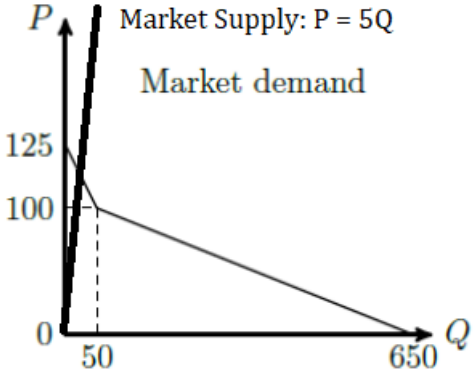
3. Find market equilibrium.

   There are several ways to solve this problem. One of them is graphing the market supply curve on the sample x-y plane as the market demand. We find that at Q = 50, the suppliers would demand a price of \$250. Looking at the graph, we know the intersection happens at the part of market demand with only Hiro's demand.

   So we solve the following system:

$$\begin{aligned} Q_S &= \frac{1}{5}P \\ Q_D &= 250 - 2P \end{aligned}$$

Table 2: Aggregate demand curve and aggregate supply curve.



In equilibrium, $Q_S = Q_D$

$$\frac{1}{5}P = 250 - 2P$$

$$P = \frac{1250}{11}$$

$$Q = \frac{250}{11}$$

2.4 Trade

Consider the pumpkin market in USA. Suppose the domestic demand for pumpkins is given by $Q = 100 - 2P$, and the domestic supply is given by $Q = 2P - 20$. Consider this market opening up to trade. For simplicity assume the USA's pumpkin output is negligible in the world pumpkin market, so its presence does not affect the world price.

1. If the world price for pumpkins is \$40, what will be the quantity demanded and supplied in the domestic market? Will the US have excess demand or supply? How large is it? Find consumer and producer surplus. How do they change (qualitatively) compared to the closed market case?

   Solution:

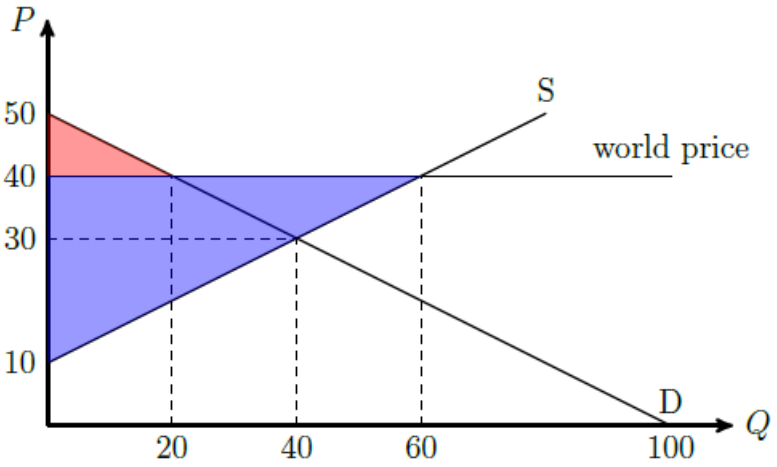
   $$Q_d = 100 - 2 \times 40 = 20$$
   $$Q_s = 2 \times 40 - 20 = 60$$
   $$Q_s > Q_d$$
   There is excess supply, which will be exports:
   $$Q_s - Q_d = 40.$$
   $$CS = \frac{1}{2}(50 - 40)20 = 100$$
   $$PS = \frac{1}{2}(40 - 10)60 = 900.$$

   In the case without trade:

   $$\text{Equilibrium price must make } Q_s = Q_d\text{: } 100 - 2P = 2P - 20$$
   $$P = 30$$
   $$Q = 40$$
   $$CS = \frac{1}{2}(50 - 30)40 = 400$$
   $$PS = \frac{1}{2}(30 - 10)40 = 400.$$

   Compared to the case without trade, CS in the case with trade is lower, PS is higher, and TS is higher.

Table 3: When P_{world} =\$40

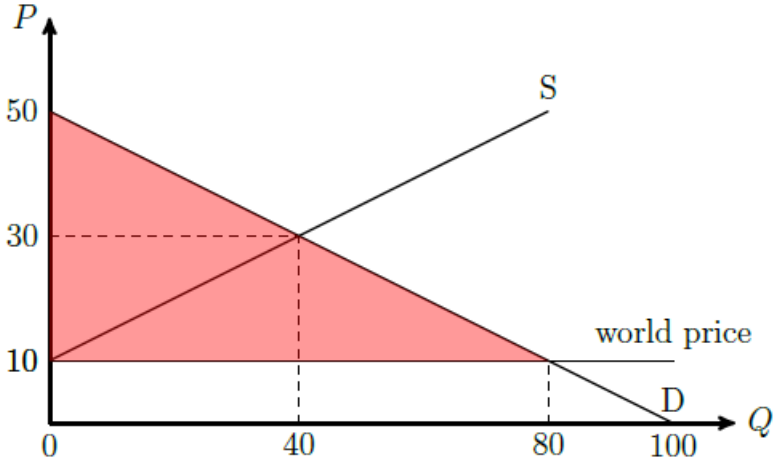


2. If the world price for pumpkins is \$10, what will be the quantity demanded and supplied in the domestic market? Will the US have excess demand or supply? How large is it? How much will consumer and producer surplus change compared to the closed market case?

   Solution: At price = 10, $Q_s = 0$, but $Q_d = 80$, with a shortage (or excess demand) of 80.

   Now PS = 0, and $CS = \frac{1}{2}(50 - 10)80 = 1600$.

Table 4: When P_{world} =\$10



3. Suppose that the world price for pumpkins is \$10, and now the US government implements a tariff of \$10, then how many pumpkins will be imported? How much revenue is raised for the government? What is the deadweight loss caused by the tariff? Illustrate on a diagram.

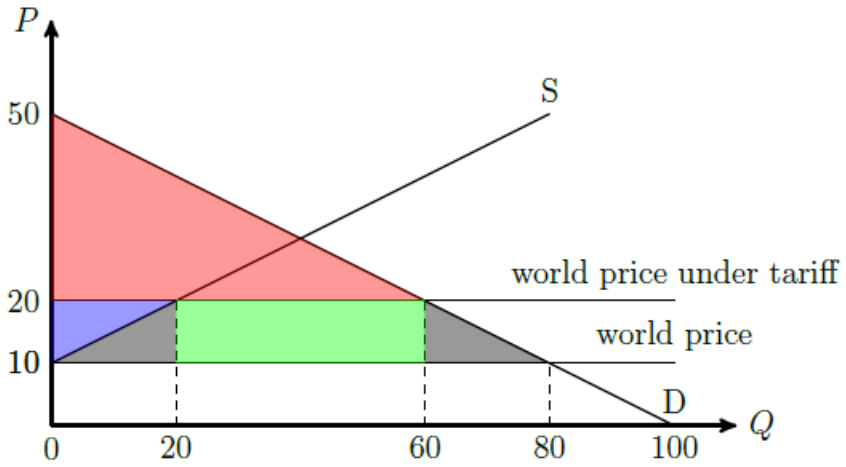
   Solution: With the tariff, the effective price consumers face is \$20. $Q_d = 100 - 2P = 100 - 2 \times 20 = 60$.

   At price = \$20, domestic producers will produce $Q_s = 2 \times 20 - 20 = 20$.

   The gap between domestic demand and domestic supply will be filled by imports, quantity of 40, and total tariff raised is $40 \times \$10 = 400$.

   The green rectangle in table 5 represents the tariff revenue going to the government, and the two gray triangles on both sides of the green rectangle represent deadweight loss.

Table 5: When P_{world} =\$10 and there is a \$10 tariff.



3 Multiple Choice Practice

3.1 Problem 1

Amy's demand for blood oranges is characterized by the equation $y = 10–x$ (assume x is on the horizontal axis). Suppose her income increases from \$200/month to \$400/month. How does her demand for the oranges change in response to the change in income?

(a) It shifts the demand curve upward to $y = 20 - x$.

(b) The demand curch does not shift, but she moves to a point further to the left on her demand curve.

(c) It shifts the demand curve downward to $y = 5 - x$.

(d) It shifts the demand curve, but we cannot determine the exact magnitude of shift.

Solution

The correct answer is (d): We don't know what kind of good blood oranges are to Amy, although we know that an increase in income will result in a shift in her demand curve, rather than just movement along the curve. How the curve shifts will depend on whether or not blood oranges are a normal good (demand will shift to the right) or inferior good (demand will shift to the left). But without more information, we don't know what the shift in her demand curve will look like.

3.2 Problem 2

The local market for pizza is characterized by the following equations:

$$Q_D = 80 - 2P$$

$$Q_S = .5P - 5$$

What are the equilibrium price and quantity?

(a) P = 12, Q = 34

(b) P = 34, Q = 12

(c) P = 24, Q = 22

(d) P = 22, Q = 36

Solution

The correct answer is (b). The key is to observe that when we are talking about equilibrium, $Q_S = Q_D$. Therefore, this is a system of two equations with two unknowns (you can just call them P and Q). Recall from the Math Review that we can solve such systems by substitution: solve for either P or Q in one of the equations and substitute it into the other equation to get one equation in one unknown. Once you solve for that variable, you can plug the value into the other equation to get the value of the other variable.

3.3 Problem 3

Suppose that the market for hotdogs is in equilibrium. What happens to equilibrium price and quantity of hotdogs under the following scenarios?

3.3.1

The price of a hamburger rises.

(a) Equilibrium price of hotdogs rises, equilibrium quantity of hotdogs rises

(b) Equilibrium price of hotdogs rises, equilibrium quantity of hotdogs falls

(c) Equilibrium price of hotdogs falls, equilibrium quantity of hotdogs rises

(d) Equilibrium price of hotdogs falls, equilibrium quantity of hotdogs falls

Solution:

The correct answer is (a). With hamburgers' price going up, more people will switch from hamburgers to hotdogs, driving up both quantity and price of hotdogs.

3.3.2

Workers' wages at hot dog shops increase and the prices of ketchup, mustard, and relish fall (ketchups, mustards, and relishes are complements to hotdogs, and are to be purchased separately from hotdogs).

(a) Equilibrium price falls, equilibrium quantity may rise or fall

(b) Equilibrium price rises, equilibrium quantity may rise or fall

(c) Equilibrium price may rise or fall, equilibrium quantity falls

(d) Equilibrium price may rise or fall, equilibrium quantity rises

(e) Equilibrium price may rise or fall, equilibrium quantity may rise or fall

Solution:
The correct answer is (b). Increase in wages would result in upward shift of supply curve, and decrease in prices of complementary goods would result in upward shift of demand curve. In the end, new intersection will be higher than previous intersection, but equilibrium quantity may be more or less than before.

3.4 Problem 4

Assume that the demand curve and the supply curve in a market are linear. When a market price is $10, a firm produces 40 units, but at that price, there is an excess demand of 20 units. Furthermore, when the market price is $20, a firm produces 80 units, but there is an excess supply of 30 units.

1. What is the equation of the demand curve in this market?

   (a) Q = 4P
   (b) Q = 70 – P
   (c) P = 40 -Q
   (d) Q = 70 -2P

   Solution:

   (b) is the answer. The two points on demand curve are (Q=60, P=10) and (Q=50, P=20).

2. What is the equation of the supply curve in this market?

   (a) Q = 4P
   (b) Q = 70 – P
   (c) P = 10 +1/4 Q

(d) Q = 4P -10

Solution:

(a) is the answer. The two points on supply curve are (Q=40, P=10) and (Q=80, P=20).

3. What is the equilibrium price in this market?

   (a) $12.

   (b) $14.

   (c) $16.

   (d) $18.

   Solution:
   (b) is the answer. Equating $Q_s = Q_d$, we have $4P = 70 - P$, or $P = \frac{70}{5} = 14$.

4. Which of the following is an effective price floor in this market?

   (a) $10.

   (b) $12.

   (c) $14.

   (d) $16.

   Solution:
   (d) is the answer. For a price floor to be effective, it must be set above the equilibrium price. If it's not above equilibrium, then the market won't sell below equilibrium and the price floor will be irrelevant.

5. What of the following describes a consequence of this price floor?

   I. It will cause deadweight loss.

   II. There will be a shortage of this good.

   III. There will be a surplus of this good.

   (a) I and II

   (b) I and III

   (c) II and III

   (d) III only

   Solution:
   (b) is the answer. With an effective price floor, consumers find they must now pay a higher price for the same product. As a result, they reduce their purchases, switch to substitutes or drop out of the market entirely. Meanwhile, suppliers find they are

guaranteed a new, higher price than they were charging before. As a result, they increase production.Taken together, these effects mean there is now an excess supply (known as a "surplus") of the product in the market. And therefore, deadweight loss is created.