Discussion 3. Solutions.

1 Topics

- Demand and Supply
- Consumer Surplus, Producer Surplus and Deadweight Loss
- Price Ceiling, Price Floor and Tariff

2 Problems

1. 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.*

   (a) The market for automobiles: Auto workers' unions successfully campaign for higher wages.

   Supply decreases/shifts left because production costs increase ⇒ Equilibrium price rises, equilibrium quantity falls.

   (b) The market for beef: Chicken becomes cheaper.

   Demand decreases/shifts left due to decreases in price of substitute ⇒ Equilibrium price and quantity fall.

   (c) The market for coffee: Cream becomes cheaper.

   Demand increases/shifts right as price of compliment falls ⇒ Equilibrium price and quantity rise.

   (d) The market for bread: Low-carb diets go out of style, and a drought ravages the wheat crop.

   Bread is now popular, so demand increases/shifts right, price of wheat (input in bread production) increases so supply decreases/shifts left ⇒ Equilibrium price rises, equilibrium quantity changes ambiguously.

   (e) The market for paperback books: Kindle becomes popular, and paper gets more expensive.

   Paperbooks are not popular so demand decreases/shifts left, price of paper (input in books production) increases so supply decreases/shifts left ⇒ Equilibrium price changes ambiguously and equilibrium quantity falls.

2. Suppose a serious Zombie virus burst out in a small town in Atlanta recently and Beta-4 antivirus is only known efficient medicine for this disease. Suppose the local demand for Beta-4 before this burst-out was $P = 250 - 0.5Q$ and the local supply for Beta-4 is $P = 50 + 0.5Q$.

   (a) Before the burst-out of Zombie virus, what was the equilibrium price and quantity of Beta-4 antivirus?

   Equate demand and supply: $250 - 0.5Q = 50 + 0.5Q$ *to get* $Q^* = 200$. *Then plug* Q^* *into either supply or demand equation to get* $P^* = 150$.

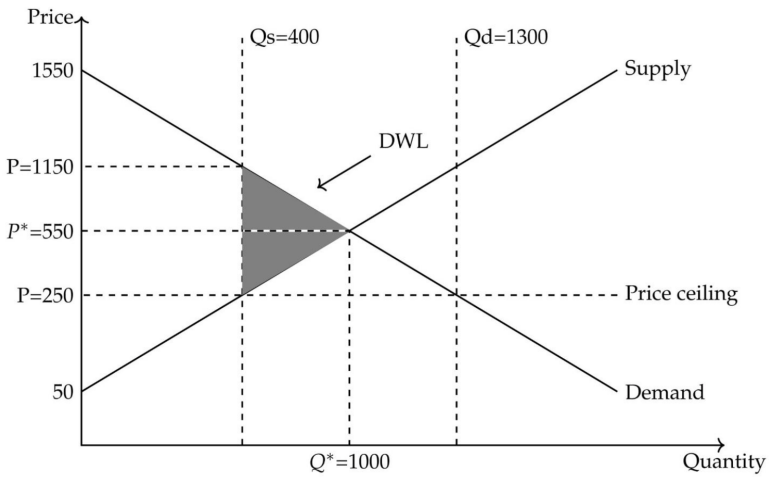
   (b) After the first week of burst-out, the demand for Beta-4 in Atlanta changes to $P = 1550 - Q$. Suppose this town could still import Beta-4 from other places in US at its previous price. What was the quantity of Beta-4 imported from other places?

   Total quantity demanded at previous price $P = 150$ *would be the solution to* $150 = 1550 - Q_d$, *hence* $Q_d = 1400$. *The quantity supplied at the same price solves* $150 = 50 + 0.5Q_s$, *so* $Q_s = 200$. *Then to fulfill the demand, town needs to import* $Q_d - Q_s = 1400 - 200 = 1200$.

   (c) Suppose all the long distance transportation was closed after a month of burst-out. Therefore this town cannot buy any Beta-4 from other places. To avoid the rapid growth of price, the local government set up a price ceiling of $ 250 per unit. What was the quantity of Beta-4 supplied and demanded in the market? How big was the deadweight loss (compared to free market)?

   Let's find equilibrium under free market: supply is $P = 1550 - Q_d$ *and demand is* $P = 50 + 0.5Q_s$. *Then equilibrium quantity is* $Q^* = 1000$ *and price is* $P^* = 550$.

   Since price ceiling (250*) is lower than equilibrium price under free market, the new price will be exactly the price ceiling. As in previous task, we need to find* Q_d *and* Q_s *at price ceiling:* $Q_s = 400$, $Q_d = 1300$.



From the graph it is easy to see that to find DWL we also need to find price that solves $Q_s = 400$, which is $P = 1150$. Then $DWL = \frac{1}{2}(1150 - 250) \cdot (1000 - 400) = 270,000$.

(d) Suppose local residents use guns to shoot the head of Zombie to protect themselves. In this scenario, what is the most likely relationship between gun and Beta-4 antivirus? (hint: complement or substitute). What is the most likely relationship between Beta-4 antivirus and food supplies?

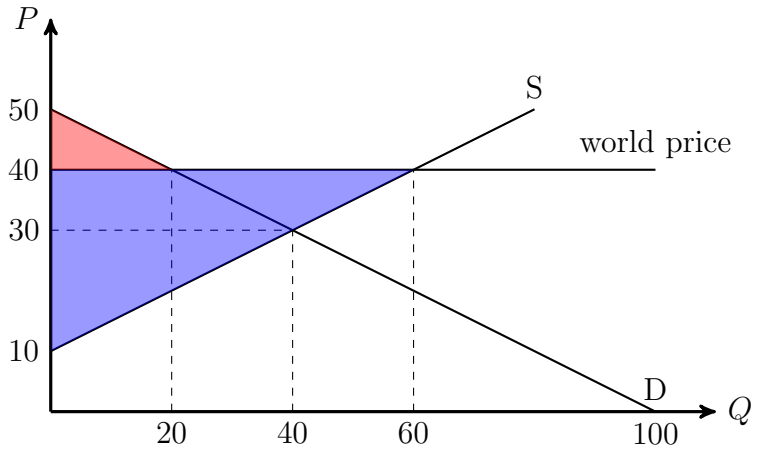
Since both guns and antivirus are measures of protection, they are substitutes. For example, if price of antivirus becomes to high, people might switch to guns. Food, on the other hand, is complement, because you need both food and antivirus in order to survive and not turn into zombie.

3. 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 is "small" in the pumpkin market, so its presence does not affect the world price.

(a) 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?

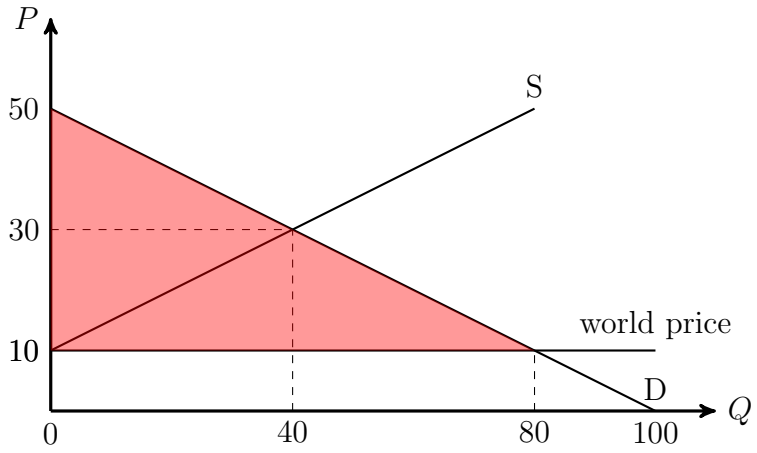
If $P = 40$, then $Q_d = 100 - 2 \cdot 40 = 20$, and $Q_s = 2 \cdot 40 - 20 = 60$. Since $Q_s > Q_d$ there is excess supply $Q_s - Q_d = 60 - 20 = 40$ After we plot everything on the graph, it is easy to see that $CS = \frac{1}{2}(50 - 40)20 = 100$, $PS = \frac{1}{2}(40 - 10)60 = 900$. CS falls, while PS increases, TS also increases.

Under closed market case we can find equilibrium by setting demand and supply equal: $100 - 2P = 2P - 20$, which gives you $P^* = 30$ and quantity $Q^* = 40$. Then $CS = \frac{1}{2}(50 - 30)40 = 400$, $PS = \frac{1}{2}(30 - 10)40 = 400$.



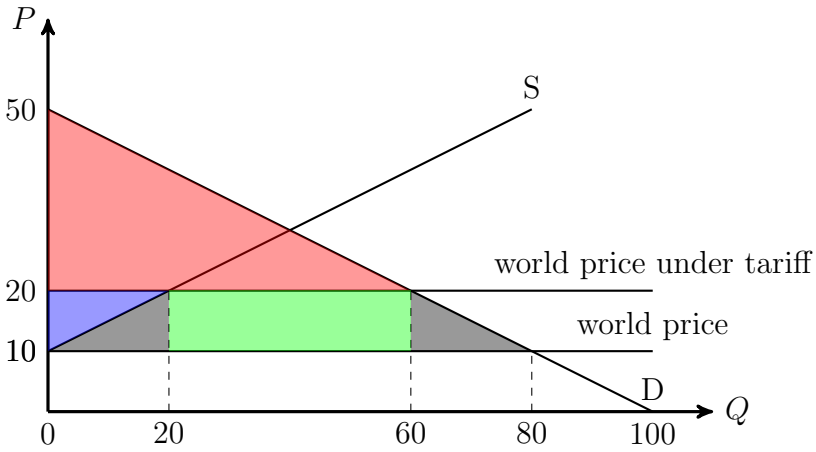
(b) If the world price for pumpkins is \$10, what will be the quantity demanded and supplied in the domestic market? Will the US have excess demand or supply? How large is it? How much will consumer and producer surplus change compared to the closed market case?

At price 10 $Q_s = 0$, while $Q_d = 80$, which generates shortage (excess demand) of 80. Now PS is 0, while $CS = \frac{1}{2}(50-10)80 = 1600$.



(c) 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.

Under tariff the effective price is 20\$. Then quantity demanded is 60 and domestic production is 20, so 40 units have to be imported. Then government will raise $40 \cdot 10 = 400$.



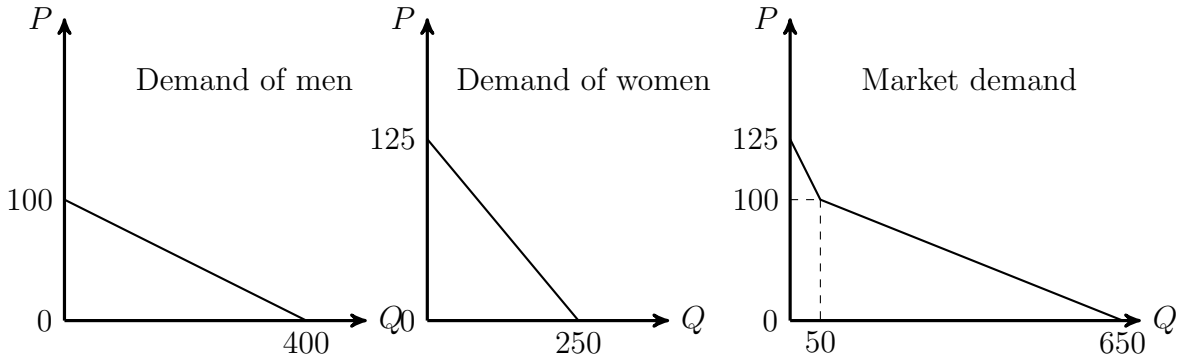
4. The following equations describe consumption of brats in Wisconsin on a given day. The first equation represents the male population, the second one represents the female population.

$$P = 100 - \frac{1}{4}Q_1$$

$$P = 125 - \frac{1}{2}Q_2$$

(a) Graph both demand curves side by side.

(b) Find the market demand equation and graph it next to the others.



First, let's rewrite our demand equations in terms of quantity:

$$Q_1 = \begin{cases} 400 - 4P, & \text{if } P \leq 100 \\ 0, & \text{if } P > 100 \end{cases}, \qquad Q_2 = \begin{cases} 250 - 2P, & \text{if } P \leq 125 \\ 0, & \text{if } P > 125 \end{cases}.$$

Then market demand will be

$$Q = \begin{cases} Q_1 + Q_2, & \text{if } P \leq 100 \\ Q_2 & \text{if } 100 < P \leq 125 \\ 0, & \text{if } P > 125 \end{cases} = \begin{cases} 650 - 6P, & \text{if } P \leq 100 \\ 250 - 2P & \text{if } 100 < P \leq 125 \\ 0, & \text{if } P > 125 \end{cases}.$$

(c) Suppose the supply for brats is $P = Q$, what is the equilibrium quantity and price of brats?

Note, that at kink point of market demand $P = 100$ *and* $Q = 650 - 600 = 50$. *Since* $100 > 50$, *supply will be crossing demand at the lower part. Then we need to solve* $P = 650 - 6P$, *which gives us* $P^* = \frac{650}{7} \approx 93$ *and* $Q^* \approx 93$.