This week, you will learn
- Demand and Supply: Market Interventions
  - Excise Taxes
  - Quantity Quota
  - Agricultural Markets (Price Floor/Support vs. Price Guarantee/Subsidy)

Exercises

Question 1 (Excise Taxes)

The demand and supply for soft drinks are given by $Q = 20 - P$ and $Q = 3P$, respectively.
1. Solve for the equilibrium price and quantity.

Suppose now the government imposes a per-unit tax of $4 on the sellers.
2. Solve for the new quantity, net price sellers received, and price consumers paid.
3. Calculate the government revenue from the taxation.
4. Calculate the deadweight loss resulting from the taxation. Point out what portion of the deadweight loss used to belong to each party.
5. What fraction of the economic incidence of the tax is borne by consumers?
6. Answer verbally, what would happen to your analysis in Part 2–5 if instead of imposing tax on the sellers, the government divides the legal burden of $1.11 per unit to consumers and $2.89 per unit to producers.

Question 2 (Quantity Quota)

Consider the market for statisticians. The demand and supply for statistician is given by $P = 200 - Q/10$ and $P = 20 + Q/20$, where P is hourly wage and Q is statisticians employed.
1. Find the equilibrium wage (price) and statisticians employed (quantity).

Suppose the Society of Highly Trained Statisticians (SH*TS) persuades the government that statisticians must be licensed. The SH*TS lets the government oversees the limited 600 licenses available.
2. What is the wage that statisticians receive? How many are employed?
3. What is the deadweight loss caused by this policy?

Question 3 (Agricultural Market Interventions)

Suppose the market for cotton is characterized by the market demand and supply equations of $P = 100 - Q/100$ and $P = Q/100$, respectively.
1. Find the equilibrium price and quantity. Point out the consumer and producer surplus

Suppose cotton farmers lobby the legislation to impose a price floor of $60 per unit, with the government purchasing any surplus to ensure the price is achieved.
2. How many units do consumers purchase? How many units does government purchase? Point out the consumer surplus and producer surplus.
3. Suppose it costs $10 per unit to store cotton, what is the total cost to the government?

Suppose instead of a price floor, the government implements a price guarantee program with a target price of $60. Farmers are paid the difference between what they receive from consumers and target price.
4. What quantity will farmers produce? What price will consumers pay?
5. How much will the government be paying farmers? Does the government have to pay the storage cost and what is the total cost?

Solution

Question 1

1. From $Q = 20 - P$ and $Q = 3P$, equate the two to solve for equilibrium price and quantity at $P^* = 5$ and $Q^* = 20 - 5 = 15$. (Note: As always, mind the axis! But sometimes, working with non-fraction equations is easy!)
2. Rewrite the demand and supply equation as $P = 20 - Q$ and $P = Q/3$.
   With \$4 tax on producers, the supply curve after tax is $P = Q/3 + 4$. Hence, the new equilibrium quantity after tax can be found from equating $P = Q/3 + 4$ and $P = 20 - Q$, so $Q/3 + 4 = 20 - Q$, which gives $Q_T = 12$.
   Price producers receive is from pre-tax supply equation $P_{net} = Q_T/3 = 12/3 = 4$.
   Price consumers pay is obtained from demand equation $P_T = 20 - Q_T = 20 - 12 = 8$, or taxed supply equation $P_T = Q_T/3 + 4 = 12/3 + 4 = 8$.
3. Government revenue is given by tax times the quantity transacted in the market so \$4 x 12 = \$48.
4. Deadweight loss is calculated from ½ x \$4 x (15 – 12) = \$6, of which \$4.5 is from consumer's under-consumption, and \$1.5 is from producer's under-production.
5. Consumer's tax incidence = (\$8 – \$5) x 12 = \$36
   Producer's tax incidence = (\$5 – \$4) x 12 = \$12
   Fraction of CTI = (\$8 – \$5)/\$4 = 3/4. Fraction of PTI = (\$5 – \$4)/\$4 = 1/4.
6. It does not matter which side of the market the tax is legally applied, the economic result would hold as long as the total amount of tax is the same.

Question 2

1. From $P = 200 - Q/10$ and $P = 20 + Q/20$, equate the two to solve for equilibrium quantity: $200 - Q/10 = 20 + Q/20$, so: $Q^* = 1{,}200$ and equilibrium price is $P^* = 20 + 1200/20 = \$80$.
2. With quantity restricted at 600 statisticians, the willingness to pay for a statistician is $P = 200 - 600/10 = \$140$. This is the wage that statistician receives. Since quota is binding, only 600 statisticians are employed.
3. Note that at quantity $Q = 600$, the willingness to supply is at wage $P = 20 + 600/20 = \$50$. Deadweight loss is calculated from ½ x (1,200 – 600) x (\$140 – \$50) = \$27,000.

Question 3

1. From $P = 100 - Q/100$ and $P = Q/100$, equate the two to solve for equilibrium quantity: $100 - Q/100 = Q/100$, so: $Q^* = 5{,}000$ and equilibrium price is $P^* = 5000/100 = \$50$.

Price floor – government buys surplus (excess supply) and pays storage cost

2. At price $P = 60$, consumers are willing to buy only $Q = 4{,}000$ solved from $60 = 100 - Q/100$. However, producers are supplying $Q = 6{,}000$ solved from $60 = Q/100$. Hence, the government must by 6,000 – 4,000 = 2,000 units.
3. Government must buy surplus of 2,000 units at \$60 each, and storage cost of \$10 per unit makes the government expenditure (\$60 + \$10) x 2,000 = \$140,000.

Price guarantee – government promises target price, producers sell all and claim the difference

4. At price $P = 60$, producers are supplying $Q = 6{,}000$. To get rid of all 6,000 units, the price must be $P = 100 - 6{,}000/100 = \$40$ to incentivize consumers to buy all.
5. Since the price sold to consumers is \$40 but the government promises \$60, the difference is \$20 per unit. At 6,000 units produced, and note that there is no storage cost, this brings the total spending to \$20 x 6,000 = \$120,000.