Producer and consumer surplus after subsidy

Suppose the demand for avocado is $Q^D = 550 - 50P$ and the industry supply curve is $Q^S = -12.5 + 62.5P$.

1. Calculate the equilibrium price and quantity.
2. Compute the consumer, producer, and total surplus for this market.
3. Suppose that the government gives producers a subsidy of \$2 per avocado sold. Draw the effect on the demand and supply curves. Compute the new equilibrium price and quantity, the consumer and producer surplus, and the government expenditure on the subsidy. Compare the government expenditure with the increase in consumer and producer surplus.

Solutions

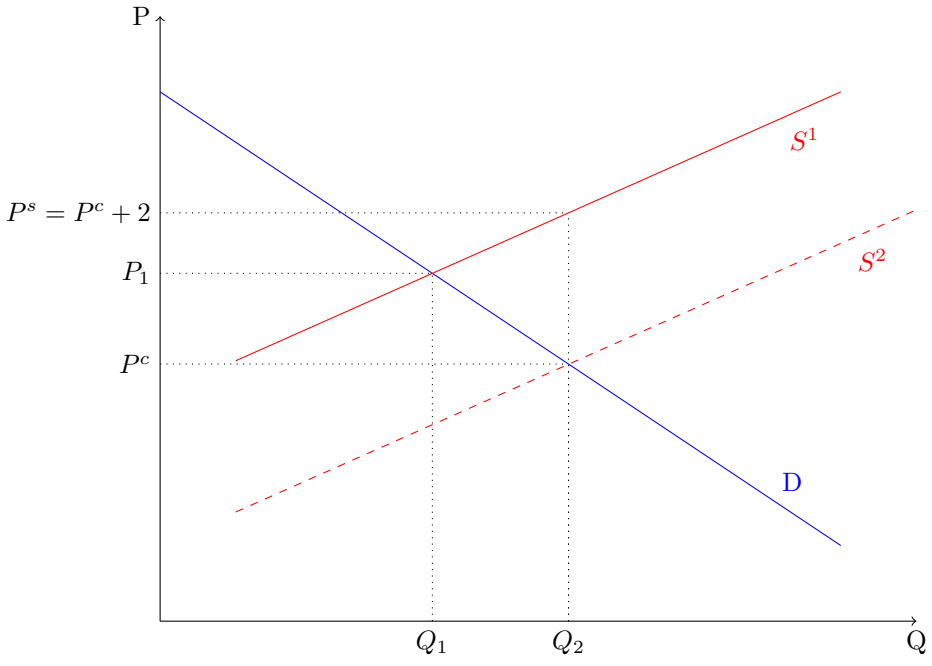
1. We find the equilibrium price by equating demand with supply.

$$\begin{aligned} 550 - 50P &= -12.5 + 62.5P \\ 562.5 &= 112.5P \\ P^* &= 5 \\ Q^* &= 300 \end{aligned}$$

2. To determine consumer surplus and producer surplus, we calculate the area above the equilibrium price and beneath the demand curve (for consumer surplus), and the area below the equilibrium price and above the supply curve (for producer surplus). These areas represent two triangles.

$$\begin{aligned} CS &= \frac{1}{2}(11-5)300 = 900 \\ PS &= \frac{1}{2}(5-0.2)300 = 720 \end{aligned}$$

3.



When consumers pay a price p, producers receive $p + 2$. Therefore, the new equilibrium will be such that

$$\begin{aligned} Q^D(p) &= Q^S(p+2) \\ 550 - 50p &= -12.5 + 62.5(p+2) \\ 437.5 &= 112.5p \\ p &= 3.89 \\ Q &= 355.55 \end{aligned}$$

Consumers pay \$3.89, while producers receive \$3.89 + \$2 = \$5.89.

Since consumers are paying a lower price, they will get a higher consumer surplus

$$CS = \frac{1}{2}(11 - 3.89)355.55 = 1263.98$$

Producer surplus will also be higher because firms are receiving a higher price

$$PS = \frac{1}{2}(5.89 - 0.2)355.55 = 1011.54$$

The total increase in producer and consumer surplus is

$$\Delta CS + \Delta PS = (1263.98 - 900) + (1011.54 - 720) = 655.52$$

Meanwhile, the government expenditure on the subsidy program is

$$\text{Expenditure} = 2 \times 355.55 = 711.1$$

The discrepancy between the government's expenditure and the sum of the consumer and producer surpluses reflect the deadweight loss associated with the subsidy. This loss occurs because the subsidy can lead to overproduction in the market, where the cost of producing additional units exceeds the value that consumers place on them.