

Exercise MT-101

Computing an equilibrium quantity with a tax

The Economic Skills Project

1 Problem

Problem

Given the willingness to pay and willingness to accept curves below, compute the equilibrium quantity when a tax of \$20 per unit is imposed.

- $WTP = 200 - Q$
- $WTA = 60 + \frac{1}{2}Q$

2 Answer

Answer

Here's the solution:

- $Q = 80$

3 Method

Solution method

Here's one approach:

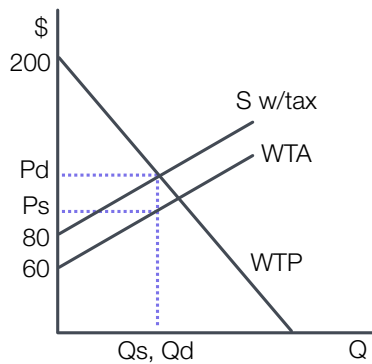
1. Draw the graph.
2. Solve for the demand and supply equations.
3. Solve for the equilibrium Q using $P^d = P^s + T$.
4. Check the result.

4 Solution

4.1 Step 1

Draw the graph

Here's how it looks:



4.2 Step 2

Solve for the demand and supply equations

Solving for demand, Q^d , as a function of the buyer price P^d :

- $WTP = 200 - Q^d$ and $WTP = P^d$ means $P^d = 200 - Q^d$
- $Q^d = 200 - P^d$

Solving for supply, Q^s , as a function of the seller price P^s :

- $WTA = 60 + \frac{1}{2}Q^s$ and $WTA = P^s$ means $P^s = 60 + \frac{1}{2}Q^s$
- $\frac{1}{2}Q^s = P^s - 60$
- $Q^s = 2P^s - 120$

4.3 Step 3

Solve for the equilibrium Q using $P^d = P^s + T$

The equilibrium has $Q^d = Q^s$ and $P^d = P^s + T$. Using those two equations and setting $T = \$20$:

- $Q^d = Q^s$
- $200 - P^d = 2P^s - 120$
- $P^d = P^s + T$
- $200 - (P^s + T) = 2P^s - 120$
- $300 - P^s - 20 = 2P^s - 120$
- $300 = 3P^s$
- $P^s = 100$
- $Q^s = 2P^s - 120 = 2 \cdot 100 - 120$
- $Q^s = 80$

4.4 Step 5

Check the result

To check the result, calculate Q^d using the demand equation. It should be exactly equal to Q^s .

- Solving for P^d :
- $P^d = P^s + T = \$100 + \$20 = \$120$
- $Q^d = 200 - P^d$
- $Q^d = 200 - 120 = 80$

Everything checks - done!