Exercise MC-102

Minimum wage using algebraic equations

The Economic Skills Project

1 Problem

Problem

The labor market for a community has the WTP and WTA curves given below. The market is initially in equilibrium and does not have a minimum wage. However, policy makers are considering imposing a minimum wage of $15. What are the impacts of the policy on employment, CS, PS, and SS?

Demand $WTP = 50 - 0.2Q$

Supply $WTA = 2 + 0.04Q$

2 Answer

Answer

Here's the solution:

- Employment would fall from 200 to 175.
- $\Delta CS = -\$937.50$
- $\Delta PS = +\$862.50$
- $\Delta SS = -\$75$

3 Method

Solution method

Here's one approach:

1. Compute the initial market equilibrium.
2. Draw the market diagram and show the minimum wage.
3. Use the WTP curve to calculate the new quantity, Q_2.
4. Use the WTP curve to calculate ΔCS.
5. Use the WTA curve to calculate ΔPS.
6. Compute ΔSS.
7. Check the results.

4 Solution

4.1 Step 1

Compute the initial equilibrium

The easiest way to find the inital equilibrium, Q_1 and P_1, is to solve for the Q that causes WTP to be equal to WTA:

$$WTP = WTA$$

$$50 - 0.2Q = 2 + 0.04Q$$

$$48 = 0.24Q$$

$$Q = 200$$

The price can then be found by putting that Q into either curve:

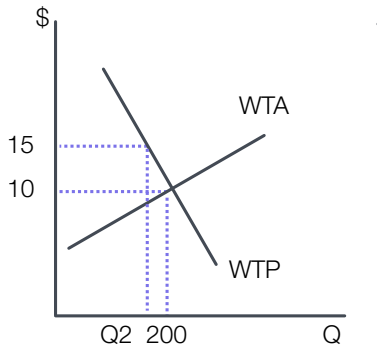
$$WTP = 50 - 0.2 \cdot 200 = \$10$$

$$WTA = 2 + 0.04 \cdot 200 = \$10$$

4.2 Step 2

Draw the market diagram

Here's how it looks, including the minimum wage and the new quantity, Q_2, that will result from it.



4.3 Step 3

Use the WTP curve to calculate Q_2

Q_2 is the amount of labor demanded at the new \$15 wage. To find it, set the *WTP* by employers equal to \$15 and solve for Q_2:

$$WTP = 50 - 0.2Q_2$$

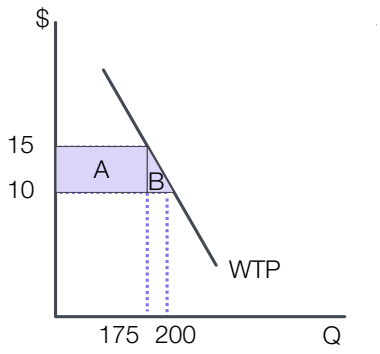
$$15 = 50 - 0.2Q_2$$

$$Q_2 = 175$$

4.4 Step 4

Use the WTP curve to calculate ΔCS

Employers lose areas A and B in the diagram below, so $\Delta CS = -A - B$. Area A is a transfer to workers and area B is deadweight loss.



Calculating ΔCS,continued

Calculating the areas:

$$A = \$5 \cdot 175 = \$875$$

$$B = \frac{1}{2} \cdot \$5 \cdot 25 = \$62.50$$

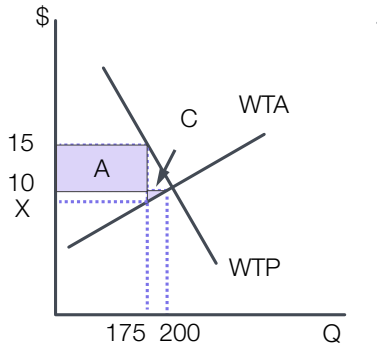
Thus:

$$\Delta CS = -\$875 - \$62.50 = -\$937.50$$

4.5 Step 5

Use the WTA curve to calculate ΔPS

Workers gain area A but lose area C in the diagram below, so $\Delta PS = A - C$. Area A is the transfer from employers and area C is deadweight loss.



Calculating ΔPS,continued

Area A was calculated above. Calculating C is a bit more involved because it's necessary to compute the value of *WTA*, shown as X in the diagram, for the last worker at Q_2. It can be found by putting the new Q into the WTA equation:

$$WTA = 2 + 0.04Q$$

$$X = 2 + 0.04 \cdot 175 = 9$$

Calculating ΔPS,continued

Area C can now be calculated:

$$C = \frac{1}{2} \cdot (Q_1 - Q_2) \cdot (P_1 - X)$$

$$C = \frac{1}{2} \cdot 25 \cdot \$1 = \$12.50$$

Finishing the calculation of ΔPS:

$$\Delta PS = \$875 - \$12.50 = \$862.50$$

4.6 Step 6

Calculate ΔSS

The overall change in social surplus is straightforward:

$$\Delta SS = \Delta CS + \Delta PS$$

$$\Delta SS = -\$937.50 + \$862.50$$

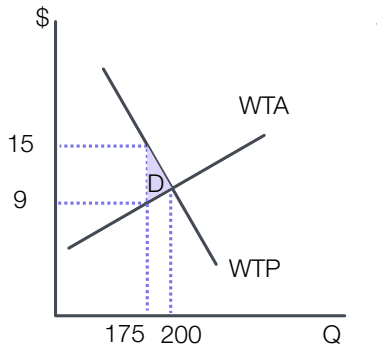
$$\Delta SS = -\$75$$

As would be expected, the policy creates a net loss.

4.7 Step 7

Check the results

A good way to check the results is to compute ΔSS and compare it to the deadweight loss triangle D in the diagram below.



Check the results, continued

Computing deadweight loss from triangle D:

$$\text{DWL} = \frac{1}{2} \cdot (200 - 175) \cdot (\$15 - \$9) = \$75$$

Everything checks - done!