Exercise MC-201

Rent control using elasticities

The Economic Skills Project

1 Problem

Problem

A city currently has 10,000 apartments that each rent for $2000 per month. There is currently no rent control in effect and the market is in equilibrium. The elasticity of demand for apartments is known to be -0.2 and the elasticity of supply is known to be 2.0. The city government is considering imposing a rent ceiling at $1800 per month. What would be the impact of the policy on consumer and producer surplus?

2 Answer

Answer

Here's the solution:

- $\Delta PS = -\$1.8M$
- $\Delta CS = -\$400,000$

3 Method

Solution method

Here's one approach:

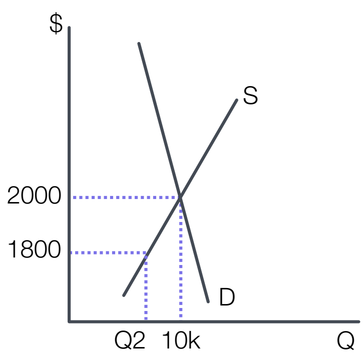
1. Draw the market diagram and show the rent ceiling.
2. Calculate the percentage changes in P and Q.
3. Calculate new quantity, Q_2.
4. Use the supply curve to calculate ΔPS.
5. Use the demand curve to calculate ΔCS.
6. Check the results.

4 Solution

4.1 Step 1

Draw the market diagram

Here's how it looks:



4.2 Step 2

Calculate the percentage changes in P and Q

The percentage change in the price will be:

$$\%\Delta P = \frac{-\$200}{\$2,000} = -10\%$$

The new quantity can be found using the *supply* elasticity:

$$\eta_S = \frac{\%\Delta Q}{\%\Delta P} = 2$$

Inserting that into the elasticity equation and solving for $\%\Delta Q$:

$$\frac{\%\Delta Q}{-10\%} = 2$$

$$\%\Delta Q = -20\%$$

4.3 Step 3

Calculate the new quantity

The change in Q will be:

$$\Delta Q = -0.2 \cdot 10000 = -2,000$$

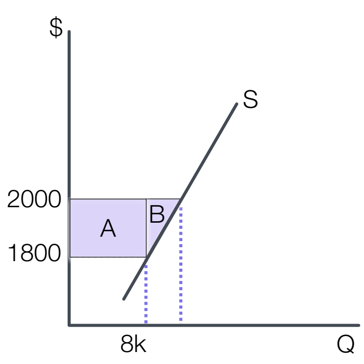
The new quantity will thus be:

$$Q_2 = 10000 - 2000 = 8,000$$

4.4 Step 4

Use the supply curve to calculate ΔPS

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



Calculating ΔPS,continued

Calculating the areas:

$$A = \$200 \cdot 8000 = \$1.6M$$

$$B = \frac{1}{2} \cdot \$200 \cdot 2000 = \$200,000$$

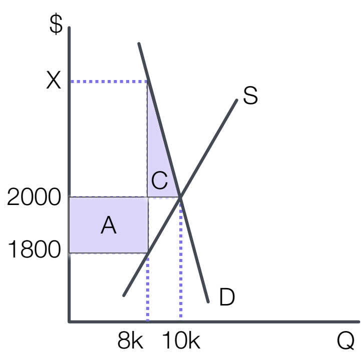
Thus:

$$\Delta PS = -1.6M - 200,000 = -1.8M$$

4.5 Step 5

Use the demand curve to calculate ΔCS

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



Calculating ΔCS,continued

Area A was calculated above. Calculating C is a bit more involved because it's necessary to compute the willingness to pay, shown as X in the diagram, of the last buyer at the new quantity. The value can be found using the *demand* elasticity and the percentage change in the quantity:

$$\eta = \frac{\%\Delta Q}{\%\Delta P} = -0.2$$

Inserting the value of $\%\Delta Q$ and solving for $\%\Delta P$:

$$\frac{-20\%}{\%\Delta P} = -0.2$$

$$\%\Delta P = \frac{-20\%}{-0.2} = 100\%$$

Calculating ΔCS,continued

The change in P is thus 100% of the original price:

$$\Delta P = \$2000$$

The value of X is will be:

$$X = P_1 + \Delta P = \$4000$$

Calculating ΔCS,continued

Area C can now be calculated:

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

$$C = \frac{1}{2} \cdot 2000 \cdot \$2000 = \$2M$$

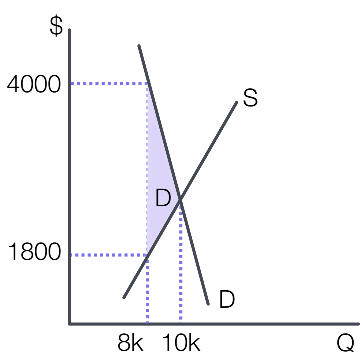
Finishing the calculation of ΔCS:

$$\Delta CS = \$1.6M - \$2M = -\$400,000$$

4.6 Step 6

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 ΔSS from ΔCS and ΔPS:

$$\Delta SS = -\$1.8M - \$400,000 = -\$2.2M$$

Computing deadweight loss from triangle D:

$$\mathrm{D}W\mathrm{L} = \frac{1}{2} \cdot (10,000 - 8,000) \cdot (\$4,000 - \$1,800) = 2.2M$$

Everything checks - done!

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