Exercise MX-101

Computing the outcome from removing a cross subsidy

The Economic Skills Project

1 Problem

Problem

A regulated firm produces two goods, X and Y, and uses a cross subsidy policy to transfer revenue from market X to Y. It charges $P_X = \$2000$ even though its $WTA_X = \$1200$ and charges $P_Y = \$4000$ even though its $WTA_Y > \$4000$. It is currently selling $Q_X = 1000$ and $Q_Y = 2000$ and breaking even on the cross subsidy. The demand elasticity in each market is -0.5.

Determine the value of WTA_Y. Then calculate what would happen to Q_X and Q_Y if the cross subsidy were removed. What would the ΔCS be in each market?

2 Answer

Answer

Here's the solution:

- $WTA_Y = \$4400$
- $Q_X = 1200$
- $Q_Y = 1900$
- $\Delta CS_X = +\$880k$
- $\Delta CS_Y = -\$780k$

3 Method

Solution method

Here's one approach:

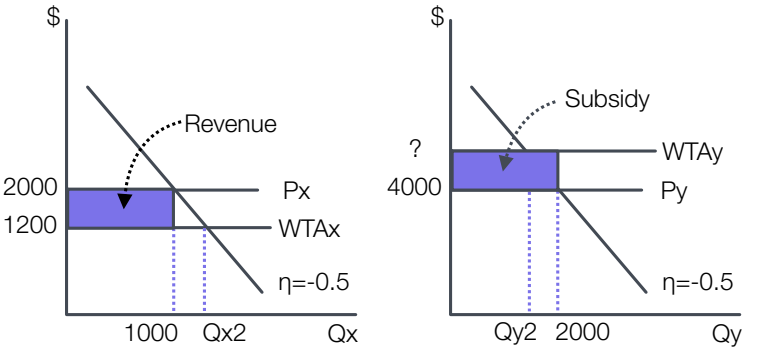
1. Draw diagrams of the two markets.
2. Calculate the tax revenue raised in the X market.
3. Calculate the subsidy expenditure in the Y market.
4. Calculate the value of WTA_Y.
5. Use the elasticities to find the new quantities.
6. Calculate the changes in CS.

4 Solution

4.1 Step 1

Draw diagrams of the two markets

Here's how they look:



4.2 Step 2

Calculate the tax revenue raised in the X market

The revenue, shown in blue in the previous graph of the X market, is the effective tax rate, $P_X - WTA_X$, times the number of units traded:

$$Rev_X = (\$2000 - \$1200) * 1000 = \$800k$$

4.3 Step 3

Calculate the subsidy expenditure in the Y market

The expenditure on the subsidy in Y, Exp_Y, is equal to Rev_X adjusted by any deficit or surplus the organization is incurring on the policy. The accounting equation below links the revenue, subsidy expenditure, and deficit Def:

$$Exp_Y - Rev_X = Def$$

Thus:

$$Exp_Y = Rev_X + Def$$

If the organization were running a surplus, Sur, similar steps would show:

$$Exp_Y = Rev_X - Sur$$

Since the budget is balanced in this problem, either approach gives:

$$Exp_Y = \$800k$$

4.4 Step 4

Calculate the value of WTA_Y

Since Exp_Y is \$800k and $Q_Y = 2000$ units are being subsidized, the subsidy per unit, S, is:

$$S = Exp_Y/Q_Y = \$800k/2000 = \$400$$

The producer price, P_Y^S, is thus:

$$P_Y^S = P_Y^D + S = \$4000 + \$400 = \$4400$$

Since supply requires $P_Y^S = WTA_Y$:

$$WTA_Y = \$4400$$

4.5 Step 5

Use the elasticities to find the new quantities, p. 1

Removing the cross subsidy would change each market's price to the corresponding WTA. For X the new P_X and the percentage change from the initial value are:

$$P_X = \$1200$$

$$\%\Delta P_X = (\$1200 - \$2000)/\$2000 = -40\%$$

Use the demand elasticity, η_X, to calculate the percent change in Q_X:

$$\%\Delta Q_X = \eta_X * \%\Delta P_X = -0.5 * (-40\%) = +20\%$$

The new value of Q_X will be:

$$Q_{X2} = 1000 + 0.2 * 1000 = 1200$$

Use the elasticities to find the new quantities, p. 2

Calculating the new P_Y and the corresponding percentage change:

$$P_Y = WTA_Y = \$4400$$

$$\%\Delta P_Y = (\$4400 - \$4000)/\$4000 = +10\%$$

Using the demand elasticity, η_Y, to calculate the percent change in Q_Y:

$$\%\Delta Q_Y = \eta_Y * \%\Delta P_Y = -0.5 * (+10\%) = -5\%$$

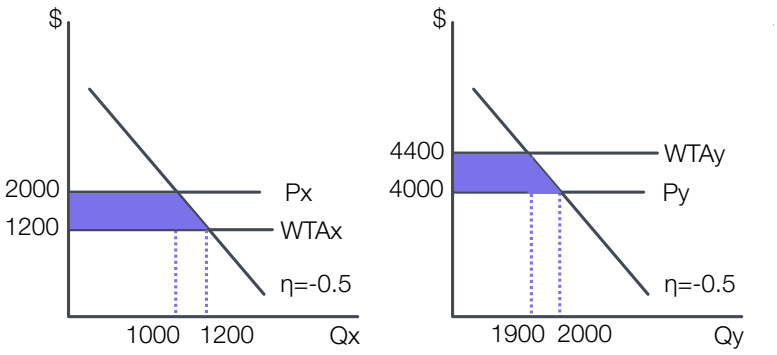
The new Q_Y is thus:

$$Q_{Y2} = 2000 - 0.05 * 2000 = 1900$$

4.6 Step 6

Calculate the changes in CS, p. 1

A good first step is to draw each diagram.Here's how they look:



Calculate the changes in CS, p. 2

Each ΔCS can be calculated using the formula for the area of a trapezoid:

$$A = (\frac{b_1 + b_2}{2}) * h$$

For X:

$$\Delta CS_X = (\frac{1000 + 1200}{2}) * \$800 = +\$880k$$

For Y:

$$\Delta CS_Y = (\frac{2000 + 1900}{2}) * \$400 = -\$780k$$

Done!