Tax per unit sold

Assuming that a market could be expressed by the following demand and supply functions:

$$Q_O = 3p$$

$$Q_D = 100 - 2p$$

If the government imposes a tax of $t = 5$ per unit, to be collected from the sellers:

1. What would be the price paid by the consumers?

2. How much would the tax collect? What fraction of the amount collected from the tax would be paid by the sellers?

3. How much would be the irrecoverable loss of efficiency?

4. Plot all the above points in a single graph.

5. What would happen if the tax were charged to the consumers?

Solution

1. First, we calculate the equilibrium price and quantity:

$$3p = 100 - 2p$$

$$5p = 100$$

$$p = 20$$

$$Q = 3 * 20 = 60$$

Now, we consider the tax in the following way. Now there are two prices, on one hand, there's the price paid by demand p_d and a price received by supply p_o. $p_d - p_o = 5$, and therefore: $p_o = p_d - 5$.

$$Q_o = 3(p_d - 5)$$

Equalizing with the demand:

$$100 - 2p_d = 3p_d - 15$$

$$115 = 5p_d$$

$$p_d = 23$$

And therefore the supply price is: $p_o = 23 - 5 = 18$. And the equilibrium quantity:

$$Q_o = 3 * 18 = 54$$

2. To determine the amount collected by the tax, you must multiply the tax by the quantities sold:

$$t * Q = 5 * 54 = 270$$

Of this, a part is paid by the suppliers and another part is paid by the consumers. The part paid by consumers is the difference between the original price and the new price multiplied by the new quantity.
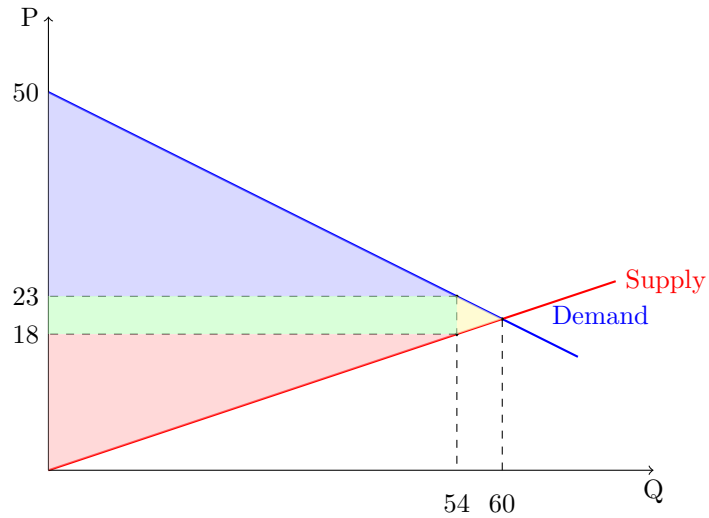
$$54 * (23 - 20) = 54 * 3 = 162$$

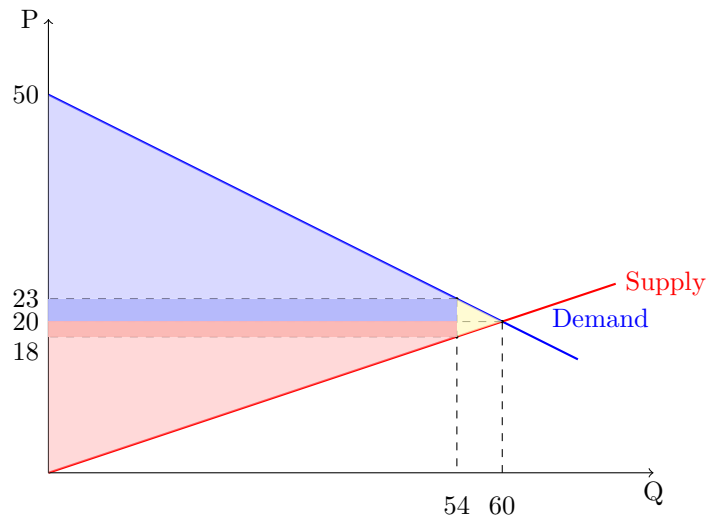And the part paid by the sellers:

$$54 * (20 - 18) = 54 * 2 = 108$$

3. The irrecoverable loss is that part that is lost from surplus but that is not collected. For calculation, we can think of the yellow triangle area of the graph in the next point:

$$\frac{base * height}{2} = \frac{(60 - 54) * (23 - 18)}{2} = \frac{6 * 5}{2} = 15$$

4. The blue area is the consumer surplus post-taxes. The red area is the producer surplus post-tax. The green area in between the two is the collection, and the yellow triangle is the irrecoverable loss or efficiency loss.

In case you want to see the part that is paid by consumers and by producers, it's necessary to further divide the surpluses:

5. Nothing would change because what determines who bears the burden of the tax does not depend on whether it is applied to consumers or to suppliers. What's relevant are the supply and demand elasticities. These determine if the tax affects consumers or sellers more.