

Cooleconomics.com**Consumer Surplus, Producer Surplus, and Efficiency**Contents

Efficiency and the existence of markets

Consumer surplus

Producer surplus

Deadweight loss of market interference

Example: price ceiling

MARKETS AND EFFICIENCY

A competitive market in equilibrium is good. Why?

1. The value of the product to buyers exceeds the amount of money that the buyers have to shell out for the product. This is known as *consumer surplus*:

consumer surplus = total value of the product to the buyers – total amount paid for the product

2. The revenue received by the sellers exceeds the minimum amount of money that sellers would have accepted for providing the product. This is known as *producer surplus*:

producer surplus = total revenue of the sellers – minimum acceptable amount for provision

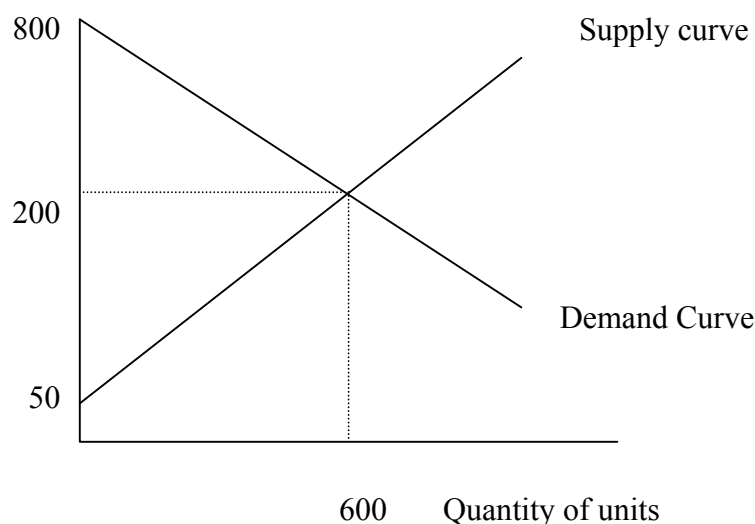
CALCULATING CONSUMER SURPLUS AND PRODUCER SURPLUS

Let's calculate consumer surplus and producer surplus for a hypothetical market. First, let's construct the hypothetical market. Let it be represented by these demand and supply equations:

$$Q_d = 800 - P \qquad Q_s = -200 + 4P$$

Equilibrium in this market (setting $Q_d = Q_s$): $P = 200$ $Q = 600$

If we graphed this market it would look like this (graph not to scale):



On the above graph, notice:

- equilibrium P is 200, equilibrium Q is 600
- the demand curve intersects the vertical axis at 800
- the supply curve intersects the vertical axis at 50

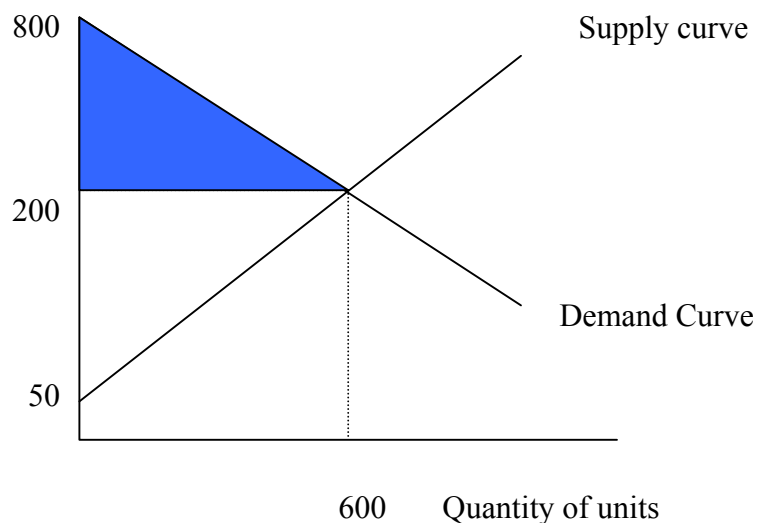
Okay, now let's calculate consumer surplus:

Note 1: *the demand curve represents the value that consumers place on the product.*

Why? Well, the demand curve tells us how much buyers are willing to pay for the product, and there's no way that buyers would pay more for a product than its value to them.

Note 2: Buyers must pay price P for each unit bought.

Implication of note 1 combined with note 2: Consumer surplus on the graph is the area between the demand curve and the price paid for the product. This is the difference between the value consumers receive from the product and the price that they must pay. It is the area of the colored triangle below:



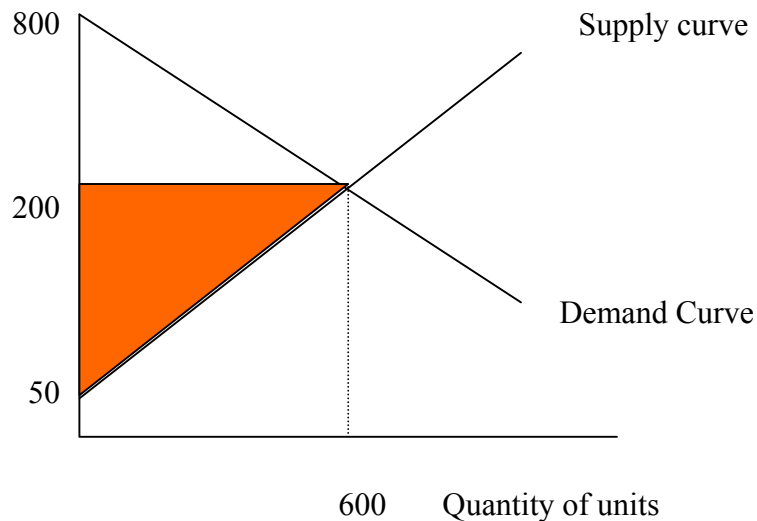
$$\begin{aligned} \text{Consumer surplus} &= \text{area of shaded triangle} \\ &= .5(800-200)600 = \$180,000 \end{aligned}$$

Okay, now let's calculate producer surplus:

Note 3: *the supply curve represents the minimum amount that sellers will take for supplying the product.* Why? Well, the supply curve tells us how much sellers are willing to supply at each price, and there's no way that sellers would supply a product if they weren't satisfied with these prices.

Note 4: Sellers receive price P for each unit bought.

Implication of note 3 combined with note 4: Producer surplus on the graph is the area between the supply curve and the price received for the product. This is the difference between the price sellers receive from the product and the minimum price that they would accept. It is the area of the colored triangle below:



$$\begin{aligned} \text{Producer surplus} &= \text{area of shaded triangle} \\ &= .5(200-50)600 = \$45,000 \end{aligned}$$

Benefit of the existence of the market:

How much better off is society because this market exists and is in equilibrium? Answer: the total benefit equals the sum of the consumer surplus and the producer surplus:

$$\text{Benefit resulting from market} = \$180,000 + \$45,000 = \$225,000$$

Equilibrium is efficient!

Equilibrium is an efficient situation in a competitive market, because this is the situation at which the sum of the consumer surplus plus producer surplus is at its maximum. The mathematics proving this assertion is beyond the scope of this course, but below we shall demonstrate that government interference which prevents equilibrium reduces the benefit resulting from the market.¹

Government interference is inefficient: deadweight loss

If government intervenes in the market, preventing the equilibrium, then they reduce the benefit resulting from the market. This reduction in benefit is known as a *deadweight loss*.

$$\begin{aligned} \text{Deadweight loss} = & \\ & \text{the benefit resulting from market in equilibrium} \\ & \text{minus} \\ & \text{the benefit resulting from market with government interference} \end{aligned}$$

¹ Fairness is not and cannot be measured using consumer surplus and/or producer surplus. Hence, there may be a benefit of government interference in a market—greater fairness—that is not captured in the analysis presented here.

Deadweight loss: An example

Let's use the hypothetical market presented above, represented by the equations $Q_d = 800 - P$ and $Q_s = -200 + 4P$, to calculate the deadweight loss caused by a government-imposed price ceiling of \$100.

We already calculated that the equilibrium in this market, with no government intervention, is $P=200$ and $Q=600$, with a benefit to society of \$225,000. So, what we need to do now is

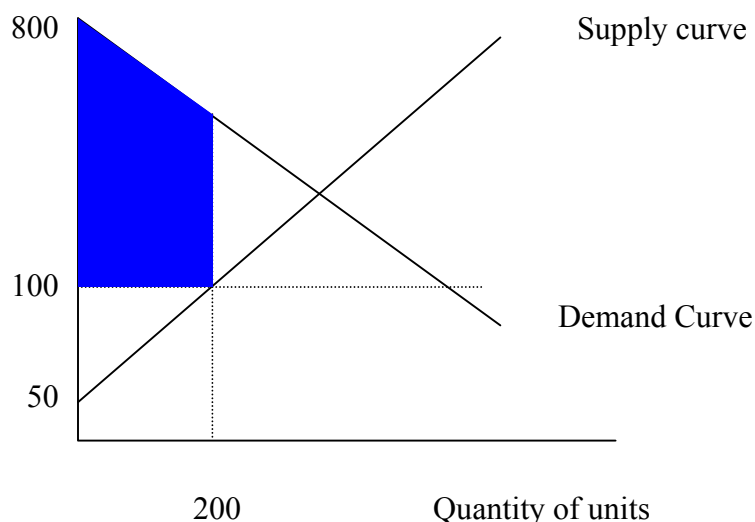
- (1) calculate the benefit to society of the market with a \$100 price ceiling
- (2) subtract (1) from \$225,000

The benefit to society of the market with a \$100 price ceiling:

Consumer surplus: With the \$100 price ceiling, the price paid by the consumer obviously falls to \$100—the legal maximum price. The quantity purchased also falls, because sellers will supply less at the \$100 price than they did at the equilibrium price of \$200. How much will they supply?

$$\text{Quantity supplied} = Q_s = -200 + 4P = -200 + 4(100) = 200.$$

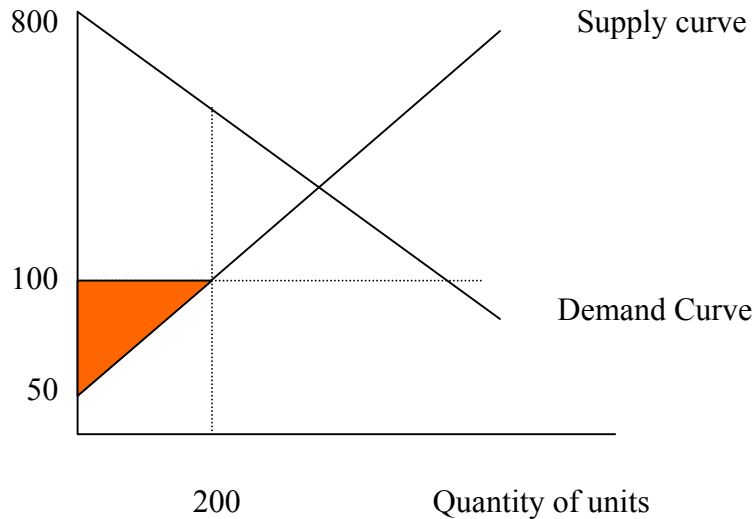
Hence, the consumer surplus is represented by the shaded trapezoid below:



You see how the shaded area represents the area between the demand curve and the price paid, given the quantity of 200 available.

$$\text{Consumer surplus} = \text{area of trapezoid} = 200(700+500)/2 = \$120,000$$

Now, the producer surplus: The producer surplus is represented by the area between the supply curve and the price of \$100. It is the shaded area in the graph below:



$$\text{Producer surplus} = .5(50)200 = \$ 5,000$$

Benefit of the market with a price ceiling:

Now we can calculate this:

$$\begin{aligned} \text{Benefit with a price ceiling} &= \text{consumer surplus} + \text{producer surplus} \\ &= \$120,000 + \$5,000 \\ &= \$125,000 \end{aligned}$$

Deadweight loss:

See how the benefit with a price ceiling imposed is less than the benefit under equilibrium

Deadweight loss =

$$\begin{aligned} &\text{the benefit resulting from market in equilibrium} \\ &\quad \text{minus} \\ &\text{the benefit resulting from market with the price ceiling} \\ &= \$225,000 - \$125,000 = \$100,000 \end{aligned}$$

This is a substantial loss. The government might as well have taken \$100,000 from citizens and thrown it down the drain. Government officials need to weigh this loss against any equity benefits that they hope to achieve with the price ceiling.