# Monopoly Market Structure[1]
# Instructional Primer[2]

In this problem we're going to take a look at the differences between monopoly and competitive goods market structures for the same good. We'll consider social welfare, consumer surplus, profit, output and price for each market form. Let's assume that the producer is a profit maximizer, that the market for the factor inputs in production of this good is perfectly competitive, and that this good's market is parameterized by the following:

Demand: $P = 100 - 4Q_D$ (1)
Marginal Revenue: $P = 100 - 8Q_D$ (2)
Costs: $MC = AC = \$20$ (3)

Let's first consider the market in a competitive form, but absent a specified supply curve. In a competitive market we know the following:

$$MC = MR = P^* \quad (4)$$

Which happens to be \$20 in this case. To find Q* we simply substitute (3) into (1)

$$\$20 = 100 - 4Q_D \quad (5)$$
$$4Q_D = 80$$
$$Q^* = 20$$

Note that both P* and Q* are equal to 20 in this case, but that's only coincidental. There's no reason to expect that these two values are the same in all cases. Also notice that the demand and marginal revenue equations are in the "inverse" form, so let's convert them each to the direct form by normalizing each on $Q_D$:

Demand:
$$P = 100 - 4Q_D$$
$$4Q_D = 100 - P$$
$$Q_D = 25 - \frac{1}{4}P \quad (6)$$

Marginal Revenue:
$$P = 100 - 8Q_D$$
$$8Q_D = 100 - P$$
$$Q_D = 12\frac{1}{2} - \frac{1}{8}P \quad (7)$$

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[1] This primer is intended to present an abbreviated discussion of the included economic concepts and is not intended to be a full or complete representation of them or the underlying economic foundations from which they are built.

[2] This primer was developed by Rick Haskell (rick.haskell@utah.edu), Ph.D. Student, Department of Economics, College of Social and Behavioral Sciences, The University of Utah, Salt Lake City, Utah (2013).

We can determine the Demand and Marginal Revenue curve intercepts by setting the variables equal to 0 in the usual manner:

Demand: if $P = 0$, then $Q_D = 25 - \frac{1}{4}(0) = 25$

if $Q_D = 0$, then $0 = 25 - \frac{1}{4}P$

$\frac{1}{4}P = 25$ and $P = 100$

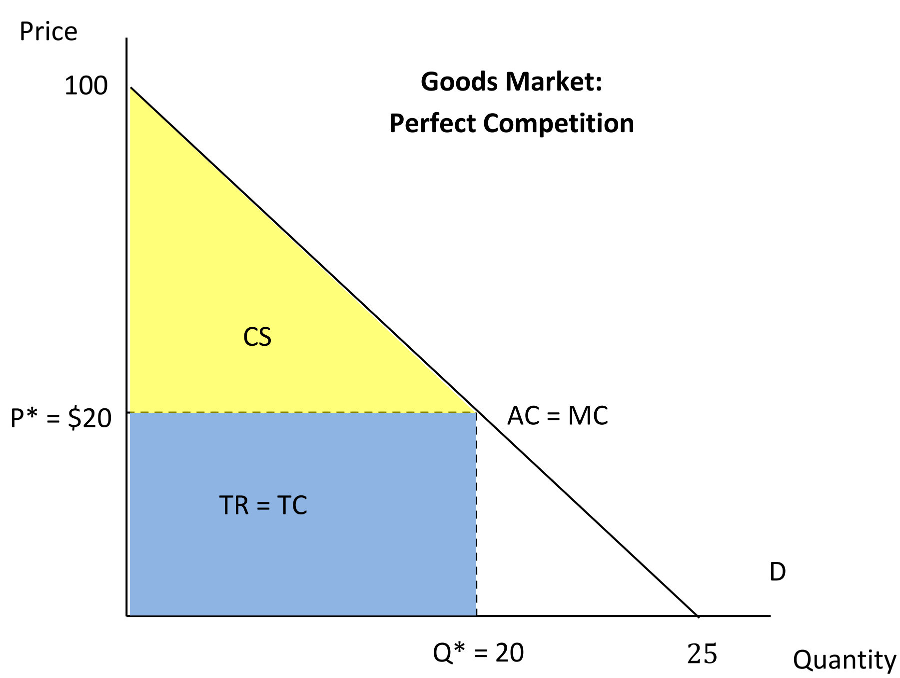
Marginal Revenue: if $P = 0$, then $Q_D = 12\frac{1}{2} - \frac{1}{8}(0) = 12\frac{1}{2}$

if $Q_D = 0$, then $0 = 12\frac{1}{2} - \frac{1}{8}P$

$\frac{1}{8}P = 12\frac{1}{2}$ and $P = 100$

Notice the Y axis (Price) intercepts for both Demand and Marginal Revenue are the same ($P = 100$) and that the X axis (Quantity) intercepts are different by a factor of 2 ($\mathrm{QD} = 25$ and $\mathrm{QD} = 12\frac{1}{2}$, respectively). This is because the Marginal Revenue curve is going to be twice as steep as the Demand curve; the scalar in front of the $Q_D$ for Marginal Revenue is twice the value of the scalar in front of $Q_D$ for Demand. In a monopoly, Marginal Revenue will transect the X axis exactly half way between 0 and the level at which the Demand curve transects it.

With that, let's take a look at the goods market model under the condition of perfect competition:



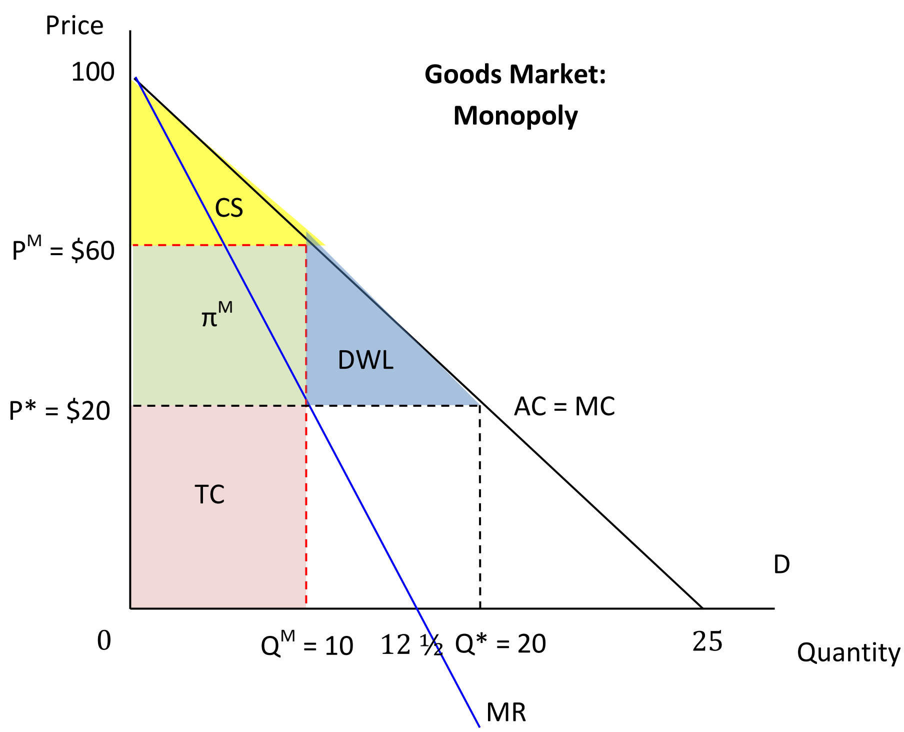
Notice that Consumer Surplus ($CS$) is the area above $P*$ and below the Demand curve. We calculate it by thinking of it simply as a right angle triangle and use the equation, $\frac{base*height}{2}$:

$$CS^C = \frac{(20)(100-20)}{2} = \$800 \tag{8}$$

We also know that in competition, profit ($\pi^C$) and Dead Weight Loss (DWL) are each equal to 0, such that

$$\pi^C = \$0; \ \ DWL = \$0 \tag{9}$$

Now let's take a look at this goods market under the condition of monopoly:




Let's look at how we calculated some of these values (remember that we already calculated the intercepts). In monopoly, the producer targets the profit maximizing condition of $MC = MR$ to determine the optimal level of output (quantity). In this case we see the Marginal Revenue curve transect Marginal Cost at $P = 20$, so all we need to do is use $P = 20$ in the Marginal Revenue equation to determine the quantity

$$Q_D = 12\tfrac{1}{2} - \tfrac{1}{8}(20) = 10 = Q^M \tag{10}$$

Now that we know $Q^M$, we can identify $P^M$ by substituting $Q^M$ for $Q_D$ into the Demand equation

$$10 = 25 - \frac{1}{4}P$$
$$\frac{1}{4}P = 15$$
$$P^M = \$60 \quad (11)$$

I've noted the areas representing $CS^M$, $TC$, $\pi^M$ (profit), and $DWL$ in this monopoly model so now we can calculate these as well as $TR^M$ with the values given:

$$CS^M = \frac{(10)(100-60)}{2} = \$200 \quad (12)$$

$$TC = (\$20 - 0)(10) = \$200 \quad (13)$$

$$\pi^M = (10)(\$60 - \$20) = \$400 \quad (14)$$

$$TR^M = TC + \pi = \$200 + \$400 = \$600 \quad (15)$$

$$DWL = \frac{(20-10)(60-20)}{2} = \$200 \quad (16)$$

Now let's turn our attention to a social welfare analysis comparing the goods market in perfect competition to one in monopoly. Social welfare in this case is the sum of the benefits society receives as a function of the market. Absent a supply curve, we'll call social welfare the sum of consumer surplus and profit such that:

$$W^C = CS^C + \pi^C = \$800 + \$0 = \$800 \quad (18)$$

$$W^M = CS^M + \pi^M = \$200 + \$400 = \$600 \quad (19)$$

$$W^C - W^M = \$800 - \$600 = DWL \quad (20)$$

Finally, this allows us to clarify $DWL$; in this case it is simply the lost societal welfare as a result of monopoly producing lower gains than those that might otherwise have been produced under perfect competition.