

Monopoly

EC 311 - Intermediate Microeconomics

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Outline

Chapter 09

- Topics
 - Market Power: Barriers to Entry (9.1)
 - Marginal Revenue (9.2)
 - Monopoly Profit Maximization (9.3)

Market Power

How Perfect is Perfect?

Up to now, we have assumed that the market is operating under **Perfect Competition**, but how reasonable of an assumption is this?

- In some contexts, producers do have to worry about how much they produce because it will directly impact the market price
 - Professional Sport Leagues
 - If they add more games to their seasons, it will likely decrease ticket prices due to higher quantity supplied
 - Actors/Actresses
 - If they are selective in the roles they take, they are able to demand higher pay for each one

We call this Imperfect Competition

Imperfect Competition

All firms that have to worry about their quantity produced share something in common:

- They make something unique (or at least “locally unique”)
- Because their goods cannot be easily obtained elsewhere, one firm’s production will impact the price of the market
 - We are no longer assuming they are perfect substitutes

In the extreme case, where a single firm is the sole producer of a unique good, they are called a **Monopoly**

Monopoly

We will figure out how a **Monopoly Firm (Monopolist)** chooses how much to produce, and how this implies they set the market price

Key Differences Between Competition Structures

Monopolist

- Choosing the quantity to produce and choosing the market price is the same thing

Perfectly Competitive Firm

- Has no say on the market price, and only chooses quantity

Understanding Monopolies

Contrary to previous lectures, I think this is easier to understand mathematically first, and then graphically

The math will show us how choosing quantity is the same as choosing prices and then we can visualize

Monopoly Profits

The **Monopolist** profit function looks the same

$$\pi = R(Q) - C(Q)$$

$$\pi = P \cdot Q - C(Q)$$

But now we have to recognize the **Key Difference** I previously mentioned:

A **Monopolist** is not a price-taker.

They are a **Price Setter**

Monopoly Setting Quantity

Whatever **Quantity** the **Monopolist** sets will, alongside the **Demand Curve**, immediately determine the market price

Take for example the following scenario

Let the **Demand Curve** be

$$P = 100 - Q$$

If the **Monopolist** produces the following quantities, what must prices be?

$$Q = 60$$

$$P = 100 - 60 = 40$$

$$Q = 70$$

$$P = 100 - 70 = 30$$

Difference in Monopoly Profit Function

So instead of having just **Price** (P) in their profits, we will substitute it for something else

$$\pi = P \cdot Q - C(Q)$$

- The **Monopolist** will plug in the **Demand Curve**
 - This is how we can model the fact that the **Monopolist Firm** will choose their optimal quantity Q^* knowing that their choice will determine P

$$\pi = \text{Demand Curve} \cdot Q - C(Q)$$

Monopoly Profit - General Case

In the most general form, we have

$$\pi = R(Q) - C(Q)$$

$$\pi = \textcolor{red}{P} \cdot Q - C(Q)$$

Let the Demand Curve be $P = f(Q_D)$

$$\pi = \textcolor{red}{f(Q_D)} \cdot Q_S - C(Q_S)$$

At Equilibrium we know that $Q_S = Q_D = Q$

$$\pi = f(Q) \cdot Q - C(Q)$$

Monopoly Profit - Example

Let a **Monopolist** face the following Costs and Demand Curve

$$C(Q) = Q^2 \quad \& \quad P = 100 - Q_D$$

Find the Profit Function of the Monopolist

Recall Profit is given by $\pi = P \cdot Q - C(Q)$

$$\pi = P \cdot Q - C(Q)$$

$$\pi = (100 - Q_D) \cdot Q_S - Q_S^2$$

Use fact that $Q_S = Q_D = Q$

$$\pi = (100 - Q) \cdot Q - Q^2$$

$$\pi = 100Q - Q^2 - Q^2$$

$$\pi = 100Q - 2Q^2$$

Maximizing Monopoly Profits

Luckily, we maximize their profits the exact same way as before

By finding Q^* from $\frac{\partial \pi}{\partial Q} = 0$

$$\pi = 100Q - 2Q^2 \quad \& \quad P = 100 - Q$$

Find the Profit Maximizing Quantity and the Market Price

Finding Profit Maximizing Quantity

$$\frac{\partial \pi}{\partial Q} = 0$$

$$100 - 4Q = 0$$

$$40Q = 100$$

$$Q_M^* = 25$$

Finding Market Price

$$P = 100 - Q_M^*$$

$$P_M^* = 100 - 25$$

$$P_M^* = 75$$

How Does This Compare to Our Perfectly Competitive Market?

Let's find and compare what we would have gotten under Perfect Competition

Monopoly

$$Q_M^* = 25$$

$$P_M^* = 75$$

Find Perfectly Competitive Equilibrium

$$C(Q) = Q^2 \quad \& \quad P = 100 - Q$$

Find Supply

$$\frac{\partial \pi}{\partial Q} = 0$$

$$P - 2Q = 0$$

$$P = 2Q$$

Set Supply = Demand

$$2Q = 100 - Q$$

$$Q_{PC}^* = 33.3$$

$$P_{PC}^* = 66.7$$

Monopoly vs Perfect Competition

Monopoly Equilibrium

$$Q_M^* = 25$$

$$P_M^* = 75$$

Perfect Competition Equilibrium

$$Q_{PC}^* = 33.3$$

$$P_{PC}^* = 66.7$$

- A **Monopoly** will always charge a **higher price** and **produce less** than the **Perfectly Competitive Market**
- This will be a recurring trend as we deal with market power
 - When firms have market power, the equilibrium will always be less than “ideal”

Monopoly

Important Note

A **Monopolist** maximizes profits by setting **Marginal Revenue = Marginal Cost** just like a **Perfectly Competitive Firm**

The main difference is that a **Monopolist's** does not equal the market price

Their choice of quantity **will** affect their **marginal revenue**

Let's see what a Monopolists Marginal Revenue looks like

Marginal Revenue

What is a Monopoly's Marginal Revenue?

We find **Marginal Revenue** in the same way we have done before, we look at Revenue and take the derivative

Let's look at a general case

Assume a linear Demand Curve: $P = a - b \cdot Q_D$

We first find Revenue

$$R(Q) = P \cdot Q_S$$

$$R(Q) = (a - b \cdot Q_D) \cdot Q_S$$

$$\text{Remember } Q_S = Q_D = Q$$

$$R(Q) = (a - b \cdot Q) \cdot Q$$

$$R(Q) = aQ - bQ^2$$

Find the Derivative

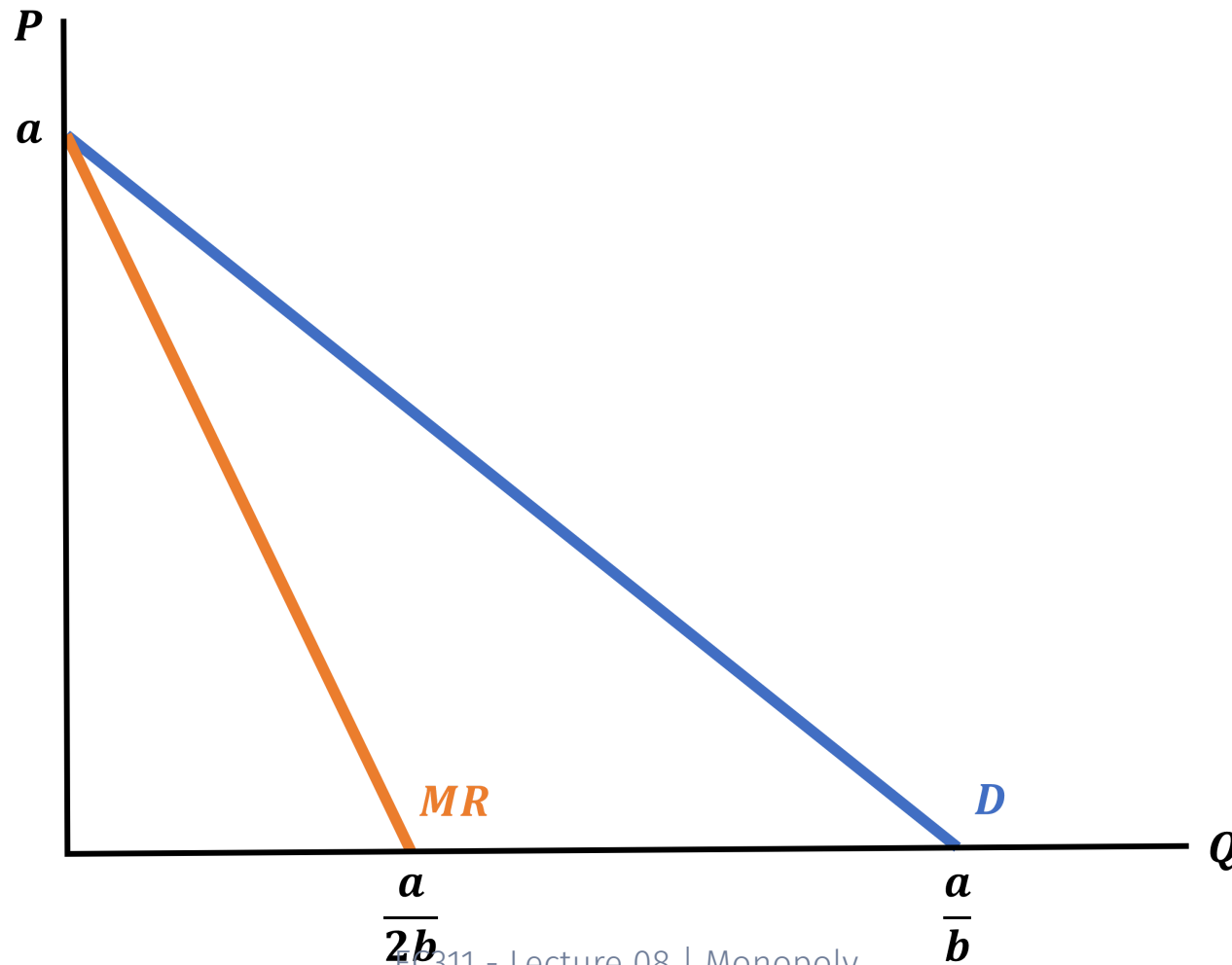
$$MR(Q) = \frac{\partial R(Q)}{\partial Q}$$

$$MR(Q) = a - 2bQ$$

Monopoly Marginal Revenue

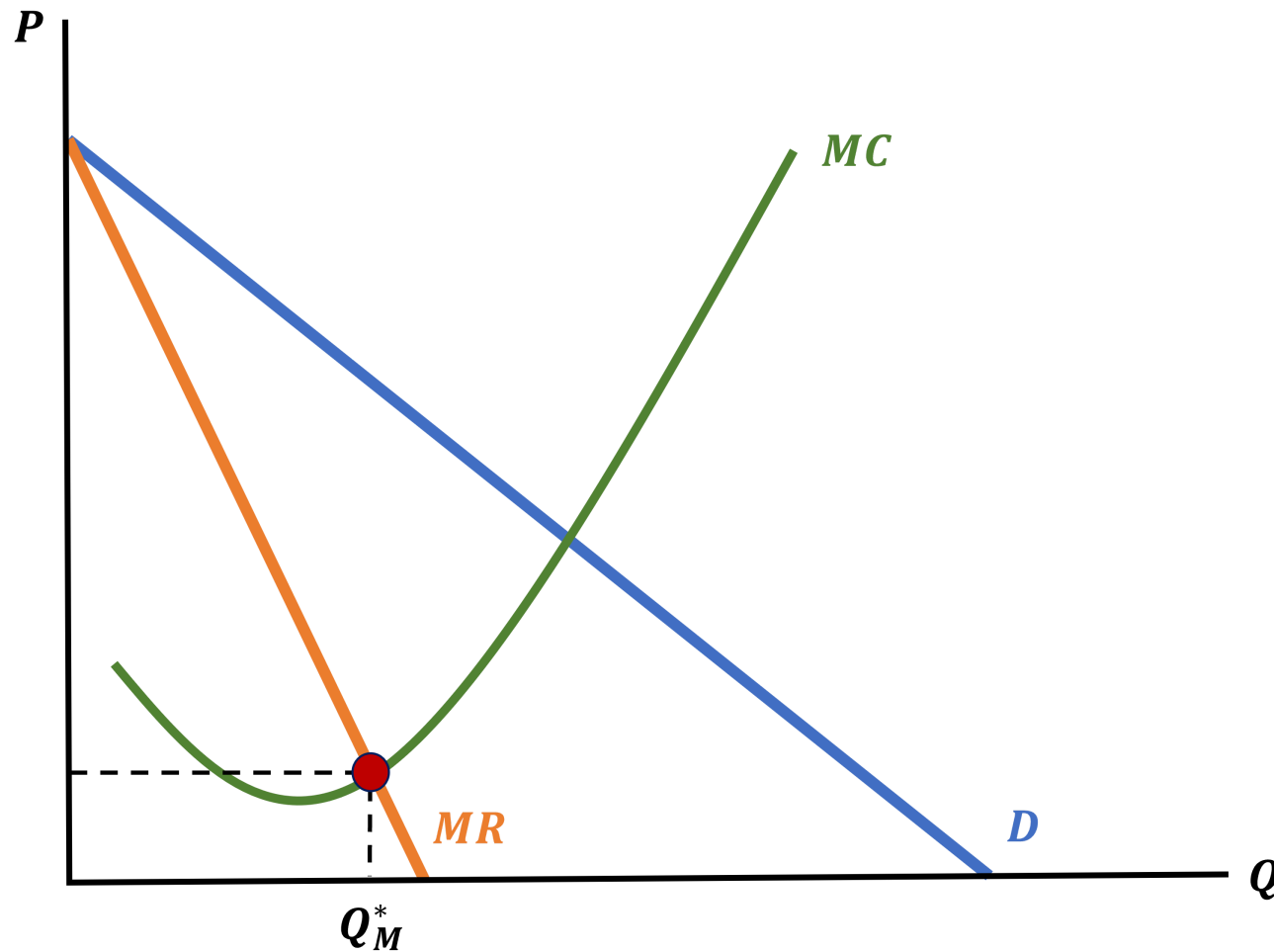
$$\text{Demand: } P = a - b \cdot Q \quad ; \quad \text{Marginal Revenue: } P = a - 2bQ$$

A **Monopolist's Marginal Revenue Curve** is just like the **Demand Curve**, except it is **twice as steep**



How Monopolists Make Their Choices

We know that **Monopolists** set **MR = MC** to maximize profits, but this only tells us the **Quantity**



How Monopolists Make Their Choices

To find the **price** P_M^* they demand at Q_M^* , we have to take one additional step

We will use the **Demand Curve**

- The **Monopolist** chose their quantity while knowing that their choice determines market price **through the Demand Curve**

How Monopolists Determine Their Market Price

We follow the **Monopoly Quantity** up to the **Demand Curve**

Monopoly Market Equilibrium

To summarize:

- We use the **Demand Curve** to find the **Marginal Revenue Curve**
- The **Monopolist** produces the **quantity** determined by setting **MR = MC**
- The **Monopolist Price** is determined by the **Demand Curve** at Q_M^*

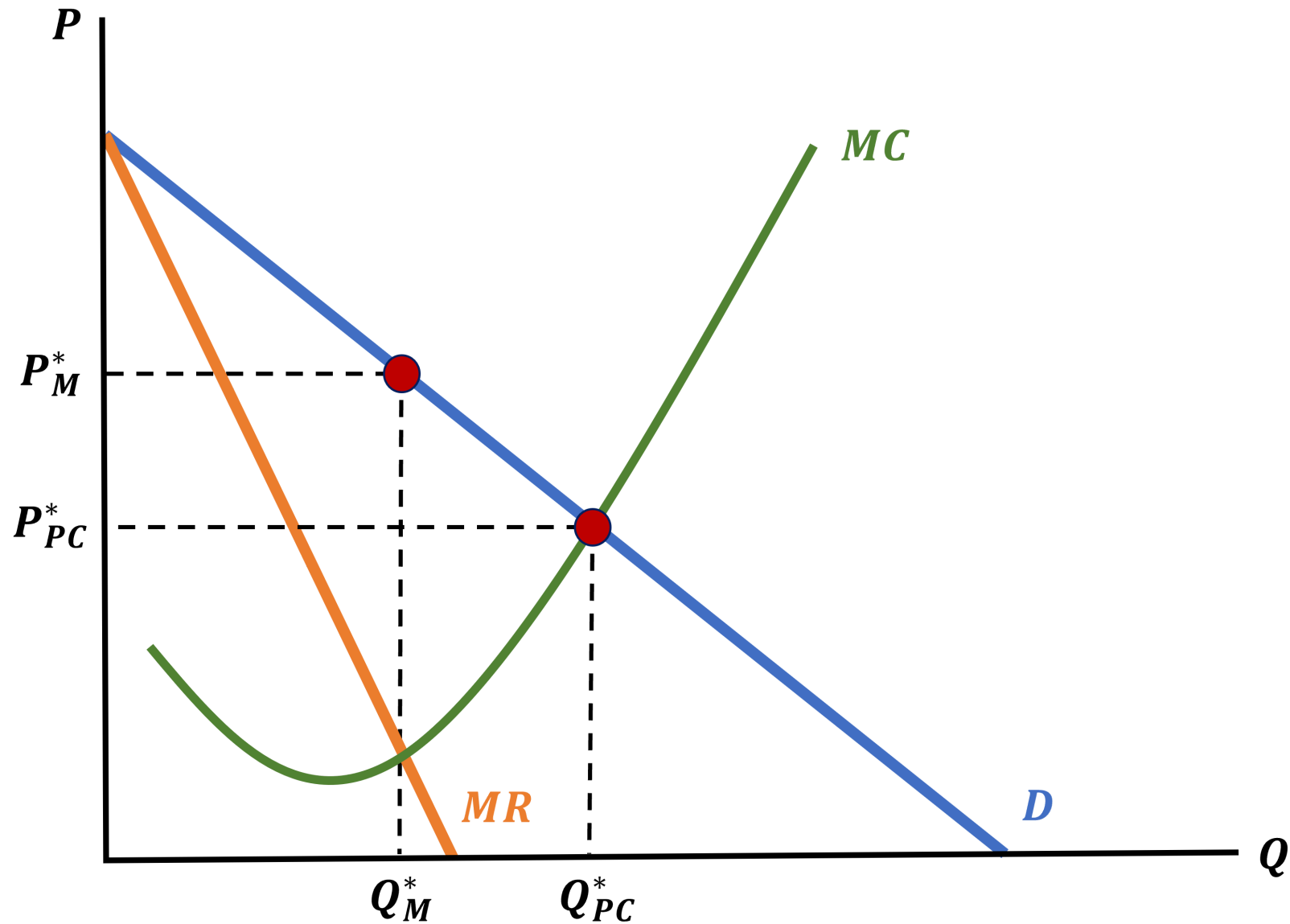
How Does This Compare to Perfect Competition?

We already showed that the **Monopolists** will produce less and demand a higher price

We can also show this on the same graph, which is useful to visualize what is happening

- Recall that the **Marginal Cost Curve** is the same thing as the **Supply Curve** in **Perfect Competition**
- The **Perfect Competition Price & Quantity** is where **Demand equals Supply**

Monopoly + Perfect Competition



Why Restrict Quantity?

Monopolists make an active choice to restrict quantity supplied, but why?

- It makes them higher profits

What about the nice tale of “all firms make zero economic profit in the Long-Run”?

Let's address it

Monopoly Long-Run Profits

The question is

Why aren't Monopolies simply eliminated by competition in the Long-Run?

There's two explanations:

1. **Monopolists** can only exist when there are **Barriers to Entry** that other firms cannot overcome
 - These tend to be either physical (think infrastructure) or legal (regulatory)
2. Even when there exist multiple firms in the market, they “**collude**” with one another and **act as if they were a monopoly**
 - We call this a **Cartel**

Now let's see how we find profits for a monopoly

Monopoly Profit Maximization

Monopoly & Perfect Competition Example

No better way to learn than by doing. Let a firm have the following cost function and face the following Demand Curve

$$C(Q) = 2Q^2 + 2Q \quad \& \quad P = 26 - 2Q_D$$

We will:

- Find the **Supply Curve, Market Equilibrium Price**, and **Quantity** assuming the firm is a **Price Taker**
- Find **Monopoly Price & Quantity**
- Show Profits are higher in the **Monopoly Market**
- Graph the found Curves
- Add the Price, Quantities, & Profits

Finding Perfect Competition Equilibrium

$$C(Q) = 2Q^2 + 2Q \quad \& \quad P = 26 - 2Q_D$$

Find the Perfectly Competitive Market Equilibrium Price and Quantity

Hint: In Perfect Competition Supply = MC

**Find the Supply
Curve**

$$P = MC$$

$$P = 4Q_S + 2$$

Set Supply Equal to Demand
Remember $Q_S = Q_D = Q$

Supply = Demand

$$4Q + 2 = 26 - 2Q$$

$$6Q = 24$$

$$Q_{PC}^* = 4$$

$$P_{PC}^* = 26 - 2Q^*$$

$$P_{PC}^* = 26 - 2(4)$$

$$P_{PC}^* = 18$$

Finding Monopoly Equilibrium

$$C(Q) = 2Q^2 + 2Q \quad \& \quad P = 26 - 2Q_D$$

Find the Monopoly Equilibrium Quantity and Price

Remember that Monopolists will include the Demand Curve in their Revenue

Monopolists Find Quantity from $MR = MC$

$$R(Q) = P \cdot Q$$

$$R(Q) = (26 - 2Q) \cdot Q$$

$$R(Q) = 26Q - 2Q^2$$

Marginal Revenue

$$MR = \frac{\partial R(Q)}{\partial Q}$$

$$MR = 26 - 4Q$$

Set $MR = MC$

$$MR = MC$$

$$26 - 4Q = 4Q + 2$$

$$8Q = 24$$

$$Q_M^* = 3$$

$$P_M^* = 26 - 2Q_M^*$$

$$P_M^* = 26 - 2(3)$$

$$P_M^* = 20$$

Show Profits are Higher in Monopoly Market

$$\pi = P \cdot Q - C(Q)$$

Find both Market Profits and Compare Them

Perfect Competition Profits

$$P = 18 \text{ \& } Q = 4$$

$$\pi_{PC} = 18 \cdot 4 - 2(4)^2 - 2(4)$$

$$\pi_{PC} = 72 - 32 - 8$$

$$\pi_{PC} = 32$$

Monopoly Profits

$$P = 20 \text{ \& } Q = 3$$

$$\pi_M = 20 \cdot 3 - 2(3)^2 - 2(3)$$

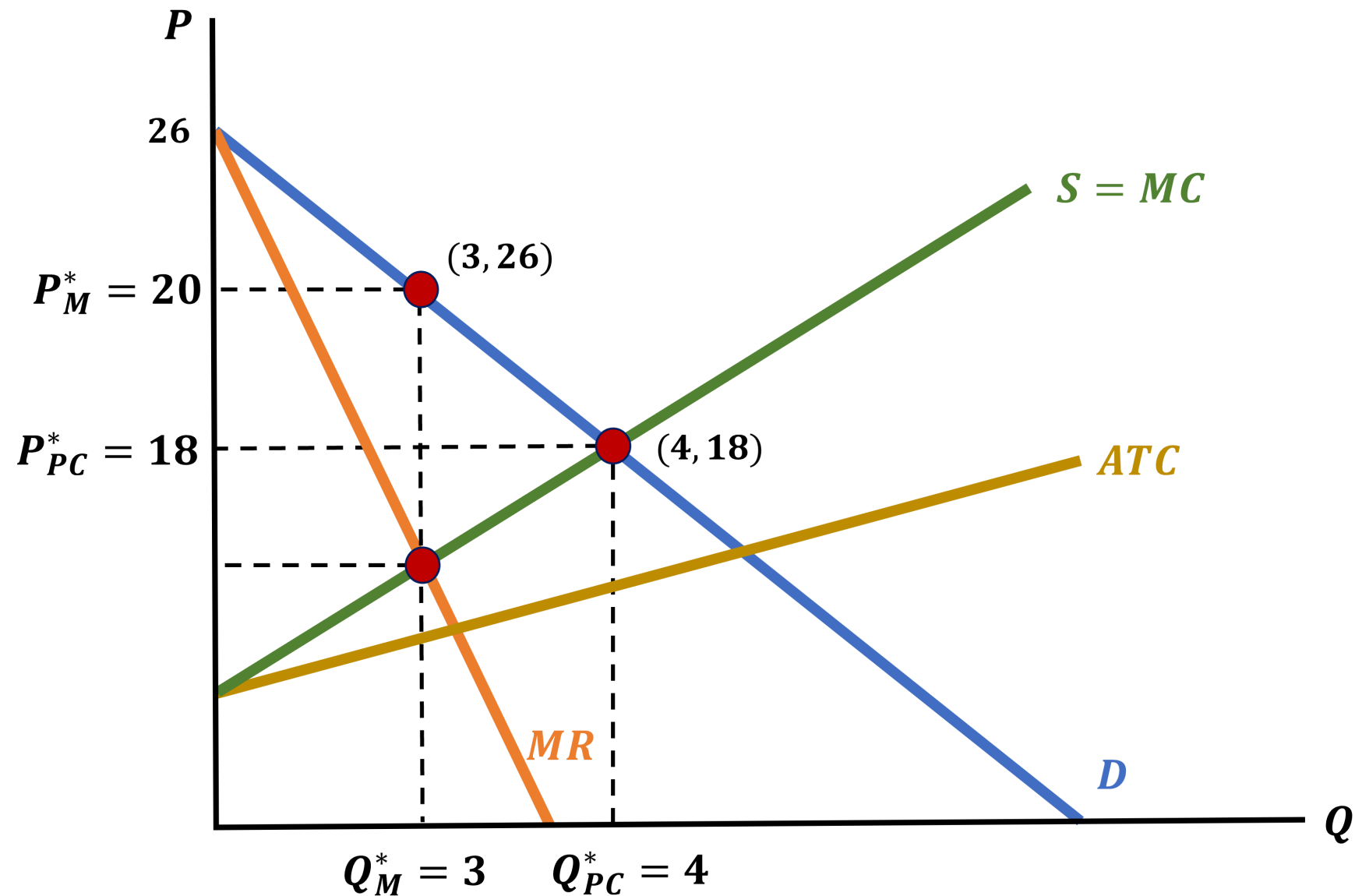
$$\pi_M = 60 - 18 - 6$$

$$\pi_M = 36$$

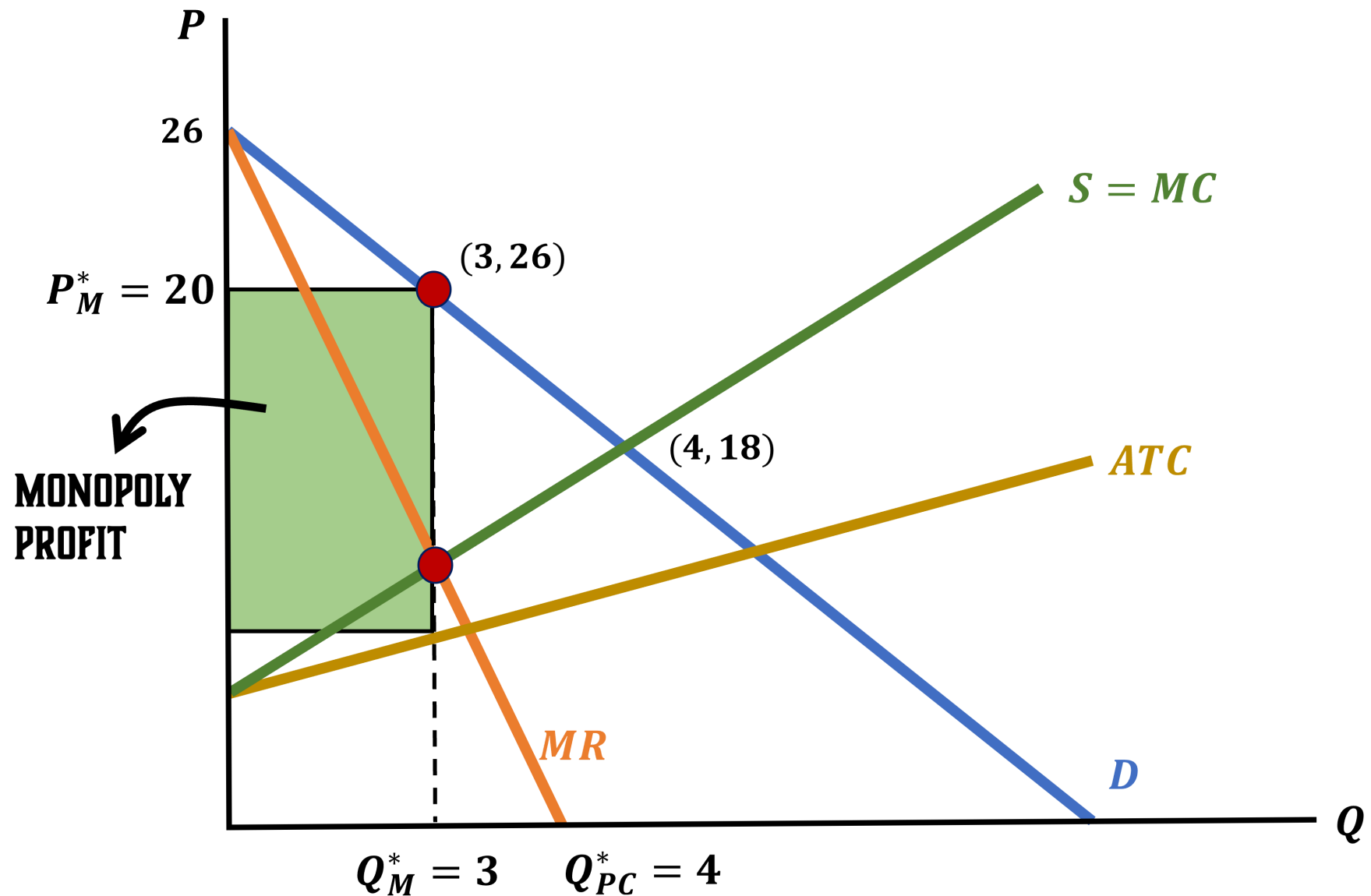
Which Market Gives Larger Profits?

$$\pi_{PC} < \pi_M$$

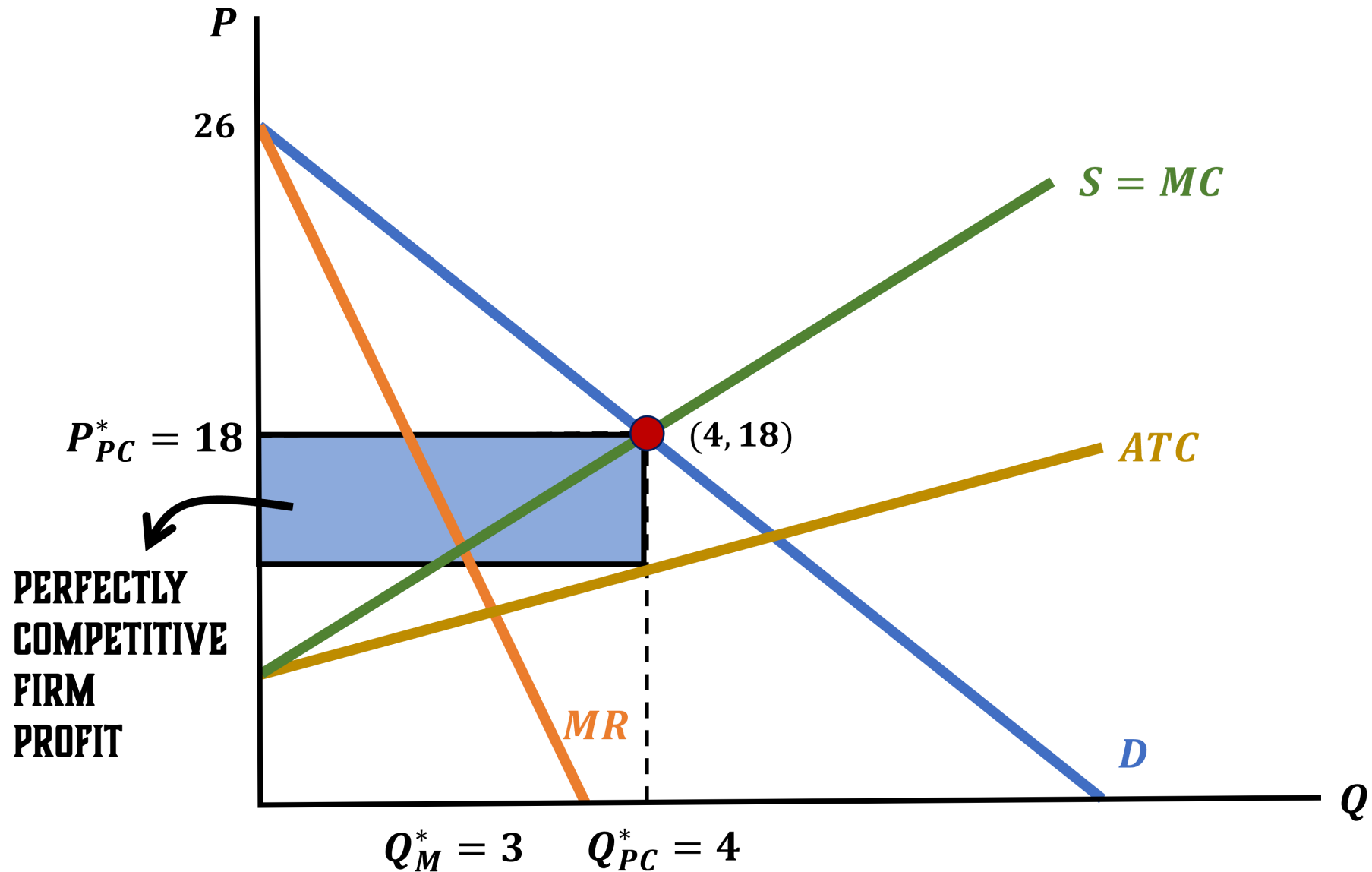
Graphing Both Markets



Graphing Monopoly Profits



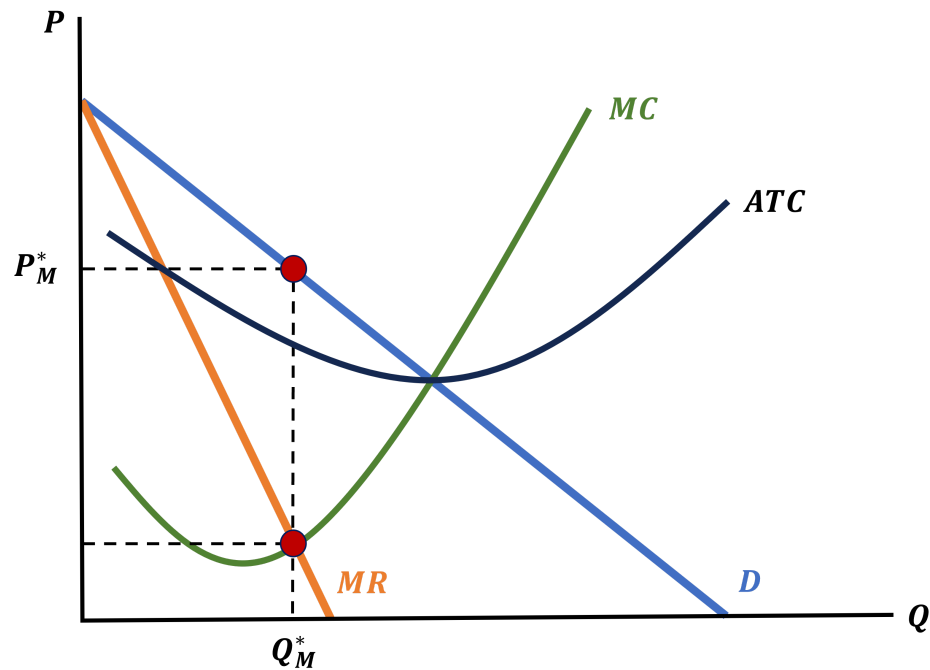
Graphing Perfect Competition Profits



Important Equilibrium Graphs

One very important takeaway is to know how Perfectly Competitive Firms and Monopolies graphs look like

Monopoly



Perfect Competition

