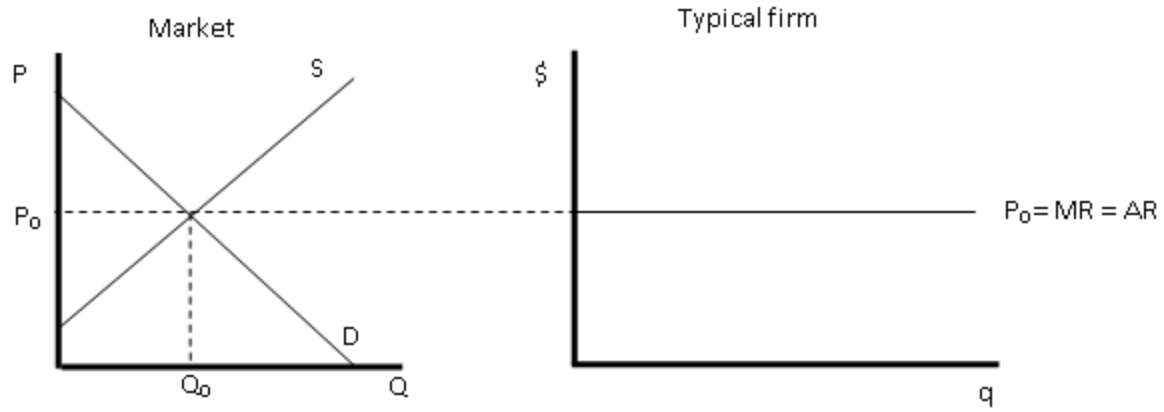
Lecture # 15 – Profit Maximization

I. Profit Maximization: A General Rule

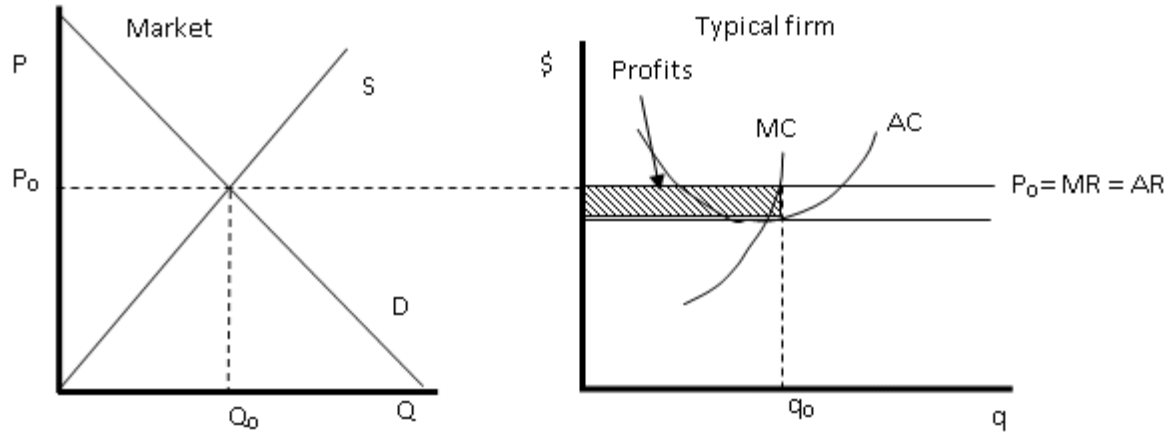
- Having defined production and found the cheapest way to produce a given level of output, the last step in the firm's problem is to decide how much output to produce. This is profit maximization.
- Profit = total revenue - total cost.
  - Total revenue -- the amount of money the firm gets from the sale of output.
  - Average revenue -- revenue per unit sold.
  - Marginal revenue -- revenue gained by selling one additional unit.
- Profits are maximized when *marginal revenue = marginal cost*.

II. Profit Maximization in Perfect Competition

- MC = MR maximizes profits for any market structure. What differs across market structures is marginal revenue. We begin by looking at perfect competition.
- Recall the features of perfect competition:
  1. Many buyers and sellers, so that price is taken as given
     - No one firm can influence price.
  2. Firms sell identical products
     - It doesn't matter who you buy from.
  3. Perfect information
     - Everyone knows their options.
  4. No barriers to entry or exit
     - Anyone who wants to enter the market (or leave the market if they are losing money) can.
- In perfect competition, firms are *price takers*.
  - MR = P = AR in perfect competition.
    - Thus, an individual firm's demand curve is a straight line -- it is perfectly elastic.



- We can use P = MR = AR to show profits on a diagram that includes AC, MC, MR, and AR.
  - The vertical distance between average revenue (or price) and average cost is the average profit, or profit per unit.
  - Multiplied by the quantity sold, this becomes total profit.
  - Graphically, this is the shaded rectangle below.



- The shut down point
  - Recall that fixed costs are sunk in the short run. They must be paid whether or not the firm operates.
  - Thus, if the firm can cover its variable costs, it should operate in the short run, even if it is losing money.
  - The firm should operate as long as P >= AVC.
    - If P > AVC, the firm is making enough money to cover the variable costs of production, and also some money that it can apply towards its fixed costs.
    - It may lose money, but it would lose more if it shut down.
  - If P < AVC, the firm shuts down.
    - If the firm operated, it would not even make enough money to cover its variable costs.
  - The next page shows the numbers from the handout in class.

Numerical Examples of Profit Maximization

Numerical Example #1 – Price = 20

Q	MR = P	TR	TFC	TVC	TC	AC	AVC	MC	Profit
1	20	20	10	5	15	15.0	5	5	5
2	20	40	10	12	22	11.0	6	7	18
3	20	60	10	21	31	10.3	7	9	29
4	20	80	10	32	42	10.5	8	11	38
5	20	100	10	45	55	11.0	9	13	45
6	20	120	10	60	70	11.7	10	15	50
7	20	140	10	77	87	12.4	11	17	53
8	**20**	**160**	**10**	**96**	**106**	**13.3**	**12**	**19**	**54**
9	20	180	10	117	127	14.1	13	21	53
10	20	200	10	140	150	15.0	14	23	50

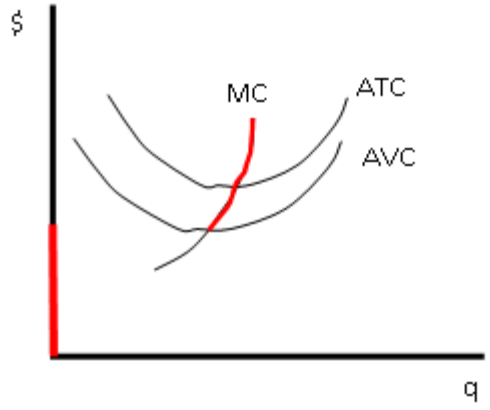
Numerical Example #2 – Price = 10

Q	MR = P	TR	TFC	TVC	TC	AC	AVC	MC	Profit
1	10	10	10	5	15	15.0	5	5	-5
2	10	20	10	12	22	11.0	6	7	-2
3	**10**	**30**	**10**	**21**	**31**	**10.3**	**7**	**9**	**-1**
4	10	40	10	32	42	10.5	8	11	-2
5	10	50	10	45	55	11.0	9	13	-5
6	10	60	10	60	70	11.7	10	15	-10
7	10	70	10	77	87	12.4	11	17	-17
8	10	80	10	96	106	13.3	12	19	-26
9	10	90	10	117	127	14.1	13	21	-37
10	10	100	10	140	150	15.0	14	23	-50

Numerical Example #3 – Price = 3

Q	MR = P	TR	TFC	TVC	TC	AC	AVC	MC	Profit
1	3	3	10	5	15	15	5	5	-12
2	3	6	10	12	22	11	6	7	-16
3	3	9	10	21	31	10.3	7	9	-22
4	3	12	10	32	42	10.5	8	11	-30
5	3	15	10	45	55	11	9	13	-40
6	3	18	10	60	70	11.7	10	15	-52
7	3	21	10	77	87	12.4	11	17	-66
8	3	24	10	96	106	13.3	12	19	-82
9	3	27	10	117	127	14.1	13	21	-100
10	3	30	10	140	150	15	14	23	-120

- We can use two lessons from profit maximization to derive the short-run supply curve for a perfectly competitive firm.
    1. If P >= AVC, the firm produces where P = MC (because P = MR for a perfectly competitive firm).
    2. If P < AVC, the firm shuts down.
    - Therefore, the supply curve is the MC curve above the AVC.

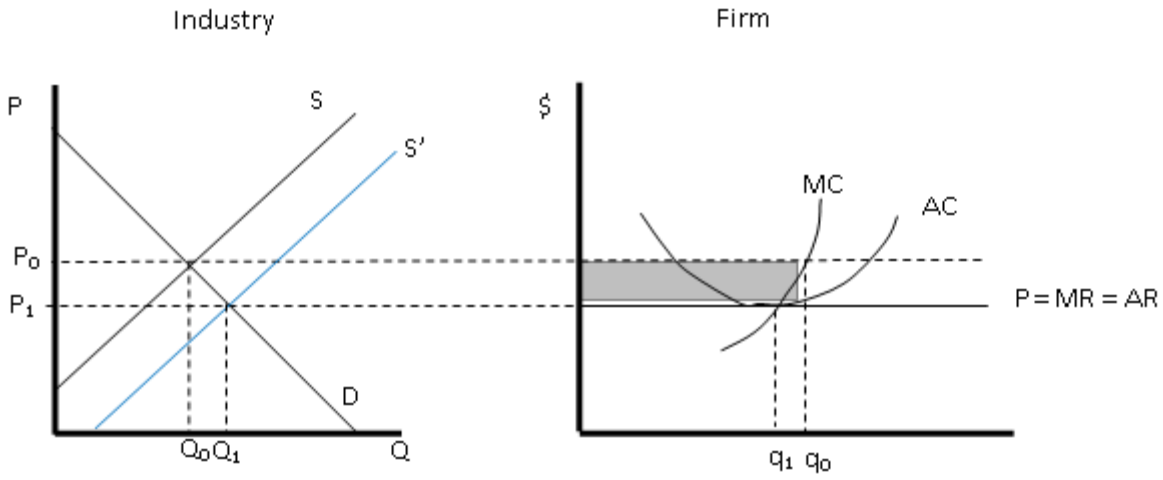


III. Profit Maximization in the Long Run

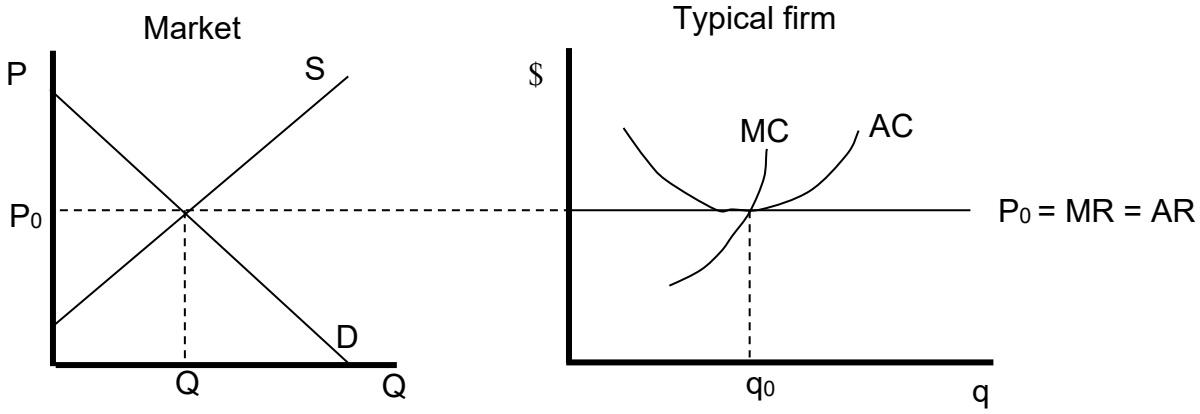
- In the short-run, firms are constrained by their fixed costs (such as the capacity of their factory). In the long-run, they can change all variables, so larger profits are possible.
- However, larger profits are *not* an equilibrium!!!
- If profits are being made, firms will enter the market.
    - This shifts the supply curve out, lowering the market price.
    - This occurs until there are no longer any economic profits.
- Similarly, if firms are losing money, firms leave the market.
    - This shifts the supply curve in, raising the market price.
    - This occurs until we reach zero economic profits.
- *Lesson*: in long-run equilibrium, there are zero economic profits.

- Definition of long-run equilibrium:
  1. All firms are maximizing profits.
  2. No firm has incentive to enter or exit, because all firms are earning zero economic profit.
     - Note that economic profits include opportunity costs
     - Thus, zero economic profit includes the value of your next best option -- what would you be earning if you weren't in your current business?
  3. Price is such that $Q_S = Q_D$.

- Note that, to do the analysis, we typically use two graphs: an industry supply and demand diagram and the cost curves for a typical firm.
  - The intersection of supply and demand determines the market price.
  - The firm takes this as given and determines its quantity by comparing price to MC.
  - If firms are making positive profits (starting at P_0 and Q_0 below), other firms will enter the market.
    - This shifts out the supply curve (the blue supply curve), lowering the price and reducing profits for each firm.
    - The process continues until there are zero economic profits.
      - The price is at the bottom of the average cost curve.



- Example: decreased demand
  - In our next example, we see what happens in a market when demand decreases
    - Demand for travel after the pandemic is an example.
  - We start by illustrating a market in long-run equilibrium.
    - Thus, the AC curve for a firm rests on the price that is determined by the market, so that there are zero economic profits.



  - The red demand curve represented the new demand. Lower demand leads to lower prices. Individual firms lose money.
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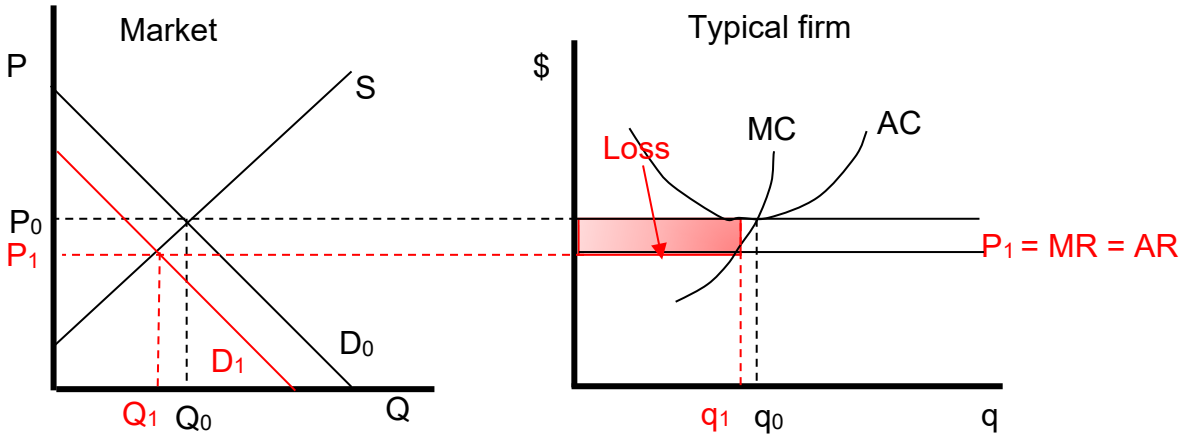

- Because firms are losing money, some firms exit the market.
  - This shifts the in curve in, raising prices.
  - Supply shifts out until firms once again earn zero economic profits. This is the blue line below. Note that prices return to their original level in this example.
  - Total quantity produced in the market falls even further, to Q_2.
  - However, the firms that remain in the market return to producing q_0. Total quantity falls simply because there are fewer firms.