We can study profit maximizing output for any firm, whether perfectly competitive or not

- Profit ($\pi$) = Total Revenue - Total Cost
- If q is output of the firm, then total revenue is price of the good times quantity
- Total Revenue (R) = Pq
Marginal Revenue, Marginal Cost, and Profit Maximization pp. 262-8

- Costs of production depends on output, $q$
  - Total Cost ($C$) = $C(q)$
- Profit for the firm, $\pi$, is difference between revenue and costs

\[
\pi(q) = R(q) - C(q)
\]
Marginal Revenue, Marginal Cost, and Profit Maximization pp. 262-8

- Firm selects output to maximize the difference between revenue and cost.
- We can graph the total revenue and total cost curves to show maximizing profits for the firm.
- Distance between revenues and costs show profits.
Marginal Revenue, Marginal Cost, and Profit Maximization  pp. 262-8

- Revenue is a curve, showing that a firm can only sell more if it lowers its price.
- Slope of the revenue curve is the *marginal revenue*
  - Change in revenue resulting from a one-unit increase in output.
- Slope of the total cost curve is *marginal cost*
  - Additional cost of producing an additional unit of output.
Profits are maximized where MR (slope at A) and MC (slope at B) are equal.
Marginal Revenue, Marginal Cost, and Profit Maximization pp. 262-8

- If the producer tries to raise price, sales are zero.
- Profit is negative to begin with, since revenue is not large enough to cover fixed and variable costs.
- As output rises, revenue rises faster than costs increasing profit.
- Profit increases until it is maxed at q*.
- Profit is maximized where MR = MC or where slopes of the R(q) and C(q) curves are equal.
Profit is maximized at the point at which an additional increment to output leaves profit unchanged

\[ \pi = R - C \]

\[ \frac{\Delta \pi}{\Delta q} = \frac{\Delta R}{\Delta q} - \frac{\Delta C}{\Delta q} = 0 \]

\[ MR - MC = 0 \]

\[ MR = MC \]
Marginal Revenue, Marginal Cost, and Profit Maximization  pp. 262-8

- The Competitive Firm
  - Price taker – market price and output determined from total market demand and supply
  - Market output (Q) and firm output (q)
  - Market demand (D) and firm demand (d)
The Competitive Firm pp. 262-8

- Demand curve faced by an individual firm is a horizontal line
  - Each firm is so small that its sales have no effect on market price. As a result, each regards market price as given.

- Demand curve faced by whole market is downward sloping
  - Shows amount of goods *all consumers* will purchase at different prices
The Competitive Firm

**Firm**

- Price $ per bushel
- Output (bushels)
- Price $ per bushel
- Output (bushels)

**Industry**

- Price $ per bushel
- Output (millions of bushels)

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Chapter 8
The competitive firm’s demand

- Individual producer sells all units for $4 regardless of that producer’s level of output
- $MR = P$ with the horizontal demand curve
- For a perfectly competitive firm, profit maximizing output occurs when

$$MC(q) = MR = P = AR$$
Cost, Revenue, Profit ($s per year)

Profits are maximized where MR=p and MC are equal

\[ R(q) = pq \]

Profits are maximized where \( R(q) - C(q) \) is maximized

\[ \pi(q) \]
In the short run, capital is fixed and a firm must choose levels of *variable inputs* to maximize profits.

We can look at the graph of MR, MC, ATC and AVC to determine profits.
A Competitive Firm

pp. 268-73

\[ q_1: MR > MC \]
\[ q_2: MC > MR \]
\[ q^*: MC = MR \]

\[ AR = MR = P \]

Lost Profit for \( q_2 > q^* \)

\[ \text{Price} \]

\[ \text{Output} \]

\[ 0 \quad 1 \quad 2 \quad 3 \quad 4 \quad 5 \quad 6 \quad 7 \quad 8 \quad 9 \quad 10 \quad 11 \]

\[ 0 \quad 10 \quad 20 \quad 30 \quad 40 \quad 50 \]
Choosing Output: Short Run pp. 268-73

The point where MR = MC, the profit maximizing output is chosen

- MR = MC at quantity, q*, of 8
- At a quantity less than 8, MR > MC, so more profit can be gained by increasing output
- At a quantity greater than 8, MC > MR, increasing output will decrease profits

See also Fig. 8-8 on p. 275 of the text for an example of actual MC curve.
A Competitive Firm – Positive Profits pp. 268-73

Profit per unit = P - AC(q) = A to B

Profits are determined by output per unit times quantity

Total Profit = ABCD

AR = MR = P
A firm does not have to make profits

It is possible a firm will incur losses if the $P < AC$ for the profit maximizing quantity

- Still measured by profit per unit times quantity
- Profit per unit is negative ($P - AC < 0$)
At $q^*$: MR = MC and $P < ATC$

Losses = $(P - AC) \times q^*$ or ABCD
Short Run Production pp. 268-73

- Why would a firm produce at a loss? *Leave as your exercise!*
  - Might think price will increase in near future
  - Shutting down and starting up could be costly
- Firm has two choices in short run
  - Continue producing
  - Shut down temporarily
  - Will compare profitability of both choices
Short Run Production pp. 268-73

- When should the firm shut down?
  - If $AVC < P < ATC$, the firm should continue producing in the short run
    - Can cover all of its variable costs and some of its fixed costs
  - If $P < AVC < ATC$, the firm should shut down
    - Cannot cover its variable costs or any of its fixed costs
A Competitive Firm – Losses

Price

Output

P < ATC but AVC so firm will continue to produce in short run
Competitive Firm – Short Run

Supply pp. 273-6

- Supply curve tells how much output will be produced at different prices
- Competitive firms determine quantity to produce where $P = MC$
  - Firm shuts down when $P < AVC$
- Competitive firms’ supply curve is portion of the marginal cost curve above the AVC curve
A Competitive Firm’s Short-Run Supply Curve

The firm chooses the output level where $P = MR = MC$, as long as $P > AVC$.

Supply is $MC$ above $AVC$.
A Competitive Firm’s Short-Run Supply Curve pp. 273-6

- Supply is upward sloping due to diminishing returns
- Higher price compensates the firm for the higher cost of additional output and increases total profit because it applies to all units
A Competitive Firm’s Short-Run Supply Curve pp. 273-6

- Over time, prices of product and inputs can change.
- How does the firm’s output change in response to a change in the price of an input?
  - We can show an increase in marginal costs and the change in the firm’s output decisions.
The Response of a Firm to a Change in Input Price

Price ($ per unit) vs. Output

Savings to the firm from reducing output

Input cost increases and $MC$ shifts to $MC_2$ and $q$ falls to $q_2$. 

Price $=$ $5$

$q_1$ $q_2$
Short-Run Market Supply Curve pp. 276-81

- Shows the amount of product the whole market will produce at given prices
- Is the sum of all the individual producers in the market
- We can show graphically how we can sum the supply curves of individual producers
The short-run industry supply curve is the horizontal summation of the supply curves of the firms.
Producer Surplus for a Firm pp. 276-81

At \( q^* \) \( MC = MR \). Between 0 and \( q \), \( MR > MC \) for all units.

Producer surplus is area above MC to the price.
Producer Surplus in the Short Run pp. 276-81

- Price is greater than MC on all but the last unit of output
- Therefore, surplus is earned on all but the last unit
- The **producer surplus** is the sum over all units produced of the difference between the market price of the good and the marginal cost of production (It indicates a firm’s gains from trade.)
- Area above supply curve to the market price
The Short-Run Market Supply Curve pp. 276-81

- Sum of MC from 0 to q*, it is the sum of the total variable cost of producing q*
- Producer Surplus can be defined as the difference between the firm’s revenue and its total variable cost
- We can show this graphically by the rectangle ABCD
  - Revenue (0ABq*) minus variable cost (0DCq*)
Producer surplus for a Firm

Price ($ per unit of output)

Producer Surplus

MC

AVC

A

B

C

D

q*

Output

Producer surplus is also ABCD = Revenue minus variable costs
Producer Surplus for a Market pp. 276-81

Market producer surplus is the difference between $P^*$ and $S$ from 0 to $Q^*$.

Producer Surplus

Price ($ per unit of output)

Output

$P^*$

$Q^*$
Choosing Output in the Long Run pp. 281-7

- *In short run, one or more inputs are fixed*
  - Depending on the time, it may limit the flexibility of the firm

- *In the long run, a firm can alter all its inputs, including the size of the plant*

- We assume free entry and free exit
  - No legal restrictions or extra costs
In the short run, a firm faces a horizontal demand curve
- Take market price as given

The short-run average cost curve (SAC) and short-run marginal cost curve (SMC) are low enough for firm to make positive profits (ABCD)

The long-run average cost curve (LRAC)
- Economies of scale to $q_2$
- Diseconomies of scale after $q_2$
In the short run, the firm is faced with fixed inputs. \( P = 40 > ATC \). 

\[ \text{Profit is equal to } ABCD. \]
In the long run, the plant size will be increased and output increased to $q_3$. Long-run profit, $EFGD > short run profit ABCD.$
Long-Run Competitive Equilibrium pp. 281-7

- For *long run equilibrium*, firms must have no desire to enter or leave the industry.
- We can relate economic profit to the incentive to enter and exit the market.
Long-Run Competitive Equilibrium pp. 281-7

- Firm uses labor (L) and capital (K) with purchased capital
- Accounting Profit and Economic Profit
  - Accounting profit: \( \pi = R - wL \)
  - Economic profit: \( \pi = R = wL - rK \)
    - \( wL \) = labor cost
    - \( rK \) = opportunity cost of capital
$\textbf{Zero-Profit}$

- A firm is earning a normal return on its investment.
- Doing as well as it could by investing its money elsewhere.
- Normal return is firm’s opportunity cost of using money to buy capital instead of investing elsewhere.
- Competitive market long run equilibrium.
Entry and Exit

- The long-run response to short-run profits is to increase output and profits
- Profits will attract other producers
- More producers increase industry supply, which lowers the market price
- This continues until there are no more profits to be gained in the market – zero economic profits
Long-Run Competitive Equilibrium – Profits pp. 281-7

- Profit attracts firms: New entrants
- Supply increases until profit = 0

Firm

\( LMC \)

\( LAC \)

\( \text{Output} \)

\( q_2 \)

Industry

\( S_1 \)

\( S_2 \)

\( D \)

\( P_1 \)

\( P_2 \)

\( Q_1 \)

\( Q_2 \)
Long-Run Competitive Equilibrium – Losses pp. 281-7

- Losses cause existing firms to leave
- Supply decreases until profit = 0

In the firm, the Long-Run Marginal Cost (LMC) intersects the Long-Run Average Cost (LAC). The output at this point is $q_2$.

In the industry, the supply decreases from $S_1$ to $S_2$, and the price decreases from $P_1$ to $P_2$. The output decreases from $Q_1$ to $Q_2$. 

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Long-Run Competitive Equilibrium pp. 281-7

1. All firms in industry are maximizing profits
   - \( p = MC \)

2. No firm has incentive to enter or exit industry
   - Earning zero economic profits

3. Market is in equilibrium
   - \( Q_D = Q_S \)
A baseball team in a moderate-sized city sells enough tickets so that price is equal to marginal and average cost (profit = 0).