Notes on Ch. 11
PERFECT COMPETITION

✧ This chapter examines the basic elements of perfect competition and the competitive firm. It examines how businesses with a given market price make production decisions that help maximizing profit.

Characteristics of Perfect Competition
1. Many firms, each is selling an identical product. Each firm’s output is a perfect substitute for the output of the other firms, so the demand for each firm’s output is perfectly elastic.
2. Large number of buyers who are indifferent from whom to buy
3. No barriers (restrictions) to entry or exit; it is relatively easy to get into the business
4. Each firm produces a very small share of the total output so that no individual firm has the market power to influence the market price of the good it produces. A perfectly competitive firm is a price taker; it takes the market price as given.
5. Firms already in the industry have no advantage over new entrants
6. Complete information is available to buyers and sellers are about price, demand, and supply in the market
7. Perfectly competitive firms earn zero economic profit in the long run (only normal profit)
Market demand curve vs. firm demand curve

- It is important to distinguish between the market demand curve and the demand curve facing a particular firm.
- The equilibrium market price is determined by the interaction of market demand and market supply curves. The market demand curve for a product is downward sloping (less than infinite). The market supply curve is upward sloping.
- However, the demand curve facing the perfectly competitive firm is different. Since the output of each firm is such a very small share of this total output, no individual firm can affect the market price. A perfectly competitive firm faces a horizontal demand curve because if it charges a higher price, customers will buy from other firms (remember, products are standardized or identical). Thus, the perfectly competitive firm faces a horizontal (perfectly elastic; infinite elasticity) demand curve. At a fixed price, the firm sells any quantity it wants. No matter of what is the quantity sold the firm charges the same price, i.e., \( P = D \)

(Notice the difference in market (in thousands of units) and individual firm (individual units) quantities on the horizontal axes of the two graphs)
Given the fixed price and the horizontal demand curve, the perfectly competitive firm faces two decisions in the short run and two decisions in the long run.

- Production decisions in SR: the firm has to decide on
  - whether to produce or shut down temporarily
  - if it to produce, how much to produce?

- Investment decisions in LR: the firm has to decide on
  - whether to enter, stay or leave the industry.
  - whether to expand or reduce the plant size,

**SHORT RUN DECISION: THE PRODUCTION DECISION**

- Since a competitive firm cannot affect market price, it has to decide what is the amount of output that will maximize the firm's total economic profit.
- To find the amount of output that maximizes profit we can use the total analysis or marginal analysis.

**Total Approach**

- Total Profit \( \pi = TR - TC \)
  - \( = TR - \text{opportunity cost} \)
- Total profit is less than TR
- To maximize profit a firm must consider how an increase in production will affect total revenues (TR) as well as total costs (TC).
- \( TR = P \times Q \). Since a perfectly competitive firm can sell all of its output at one price, the total revenue curve of a perfectly competitive firm is an upward sloping straight line, with slope equal to market (equilibrium) price (P*).
- Note that for a perfectly competitive firm \( MR = P \)
If a perfectly competitive firm wanted to maximize total revenue, it would always produce at capacity (as much as possible). However, the objective is to maximize profits not revenue.

<table>
<thead>
<tr>
<th>P</th>
<th>Q</th>
<th>TR</th>
<th>MR</th>
</tr>
</thead>
<tbody>
<tr>
<td>5</td>
<td>0</td>
<td>0</td>
<td>----</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>5</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>2</td>
<td>10</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>15</td>
<td>5</td>
</tr>
<tr>
<td>5</td>
<td>4</td>
<td>20</td>
<td>5</td>
</tr>
</tbody>
</table>

In order to calculate profit, we also have to see how costs vary with the rate of output in the short-run.

- TC is the opportunity cost of production, which includes normal profit.
- TC = Opportunity Costs = TFC + TVC
- Total costs increase as output expands. At first, they rise slowly due to the increasing marginal returns, and then they increase more quickly due to the diminishing marginal returns.
- Since profit depends on the difference between TR and TC, profit is maximized when TR exceeds TC by the largest amount.
- By putting total cost and total revenue curves together, we can identify the rates of production in which profits are maximized.
- Profit is maximized where the vertical distance between TR curve and TC curve is the largest.
- The firm suffer loss at output rate between zero and quantity “a” (where TC > TR).
The firm is profitable only at output rates between quantity “a” and quantity “b” (where TR > TC). Not all points between "a" and "b" are equally profitable. The vertical distance between total revenue and total cost varies considerably in that range.

The point in which the curves have the largest vertical distance from one another is the profit-maximizing rate of output (point m).

Beyond point "b", where TC > TR, as production capacity is approached, costs tend to increase very rapidly, offsetting any gain in sales revenue.
In conclusion, the primary objective of the producer is to produce at the level of output that maximizes profits, where the difference between TR and TC is the largest; i.e., where the vertical distance between TR curve and TC curve is the largest.

**Marginal Approach: Short Run Profit Maximizing Rule**

- The firm can use marginal analysis to determine the profit-maximizing output.
- What an additional unit of output brings in revenue is its marginal revenue (MR) and what it costs to produce is its marginal cost (MC).
- Marginal Revenue (MR) is the change in total revenue that results from a one-unit increase in the quantity sold.

\[
MR = \frac{\Delta TR}{\Delta Q}
\]

- For perfectly competitive firms, as discussed earlier in this chapter, each additional unit sold will generate an additional revenue equal to price, i.e., \( D = P = MR \)
- As you remember, marginal cost is defined as \( MC = \frac{\Delta TC}{\Delta Q} \)
- Marginal costs decline in the early stages of production (because of IMR) and increase as the available plant and equipment are used more intensely (because of DMR).
- To find the most profitable level of output, we need to know what an additional unit of output will add to the total revenue of the firm and what it will add to the total cost.
- Since \( P = MR \) in perfectly competitive markets, we can base the production decision on a comparison of \( P \) and \( MC \).
 Produce additional units of output as long as \( P > MC \). If \( P \) exceeds \( MC \), an extra unit can bring more revenue than it costs to produce, adding to total profit.

 Do not produce an additional unit of output if \( MC > P \). If \( MC \) exceeds \( P \), we are spending more to produce that extra unit than we are getting back and our total profits decline.

 A firm maximizes its profits (or minimizes its loss) by producing the level of output at which \( MR = MC \) (or \( P = MC \)). This is called the profit-maximization rule.

<table>
<thead>
<tr>
<th>Condition</th>
<th>Action</th>
<th>Profit Change</th>
</tr>
</thead>
<tbody>
<tr>
<td>( P &gt; MC )</td>
<td>Increase output; Profits increasing</td>
<td></td>
</tr>
<tr>
<td>( P = MC )</td>
<td>Maintain output at ( Q^* ); profit maximized</td>
<td></td>
</tr>
<tr>
<td>( P &lt; MC )</td>
<td>Decrease output; profit decreasing</td>
<td></td>
</tr>
</tbody>
</table>

 Equating \( MR \) (or \( P \)) to \( MC \) shows us the efficient level of output. However, this level of output does not tell us whether the firm is maximizing profit or minimizing loss.
To determine whether a firm is earning an economic profit or incurring an economic loss, we compare the firm’s average total cost, ATC, at the profit maximizing output with the market price.

It is easy to understand the concept if we know that total profit equation can be re-written in the following way:

1. Total Profit = TR – TC
2. Divide both sides by Q to get the profit per unit.
   
   \[ \frac{\text{Profit per unit}}{Q} = \frac{\text{total profit}}{Q} = \frac{TR - TC}{Q} = \frac{TR}{Q} - \frac{TC}{Q} = \frac{Q \times P}{Q} - ATC = P - ATC \]

3. Therefore, Total Profit = (profit per unit) * (quantity sold)
   
   \( = (P-ATC) \times Q \)

1. Total economic profit is maximized if \( P = MC > ATC \)
2. Total economic profit is zero (normal profit) if \( P = MC = ATC \)
3. Total economic loss is minimized if \( P = MC < ATC \)

1) Profit Maximization: Making Positive Economic Profit

If ATC curve is added to the diagram, a profit-maximizing firm will produce at the level of output \( Q^* \) at which \( P = MC > ATC \)

\[ P = 5 \]
\[ A = 3 \]
\[ Q^* = 20 \]

\[ TR = P \times Q = 5 \times 20 = 100 \text{ (the area of 0PBQ*)} \]
 TC = ATC \times Q = 3 \times 20 = 60 \text{ (the area of } 0ACQ^* )

Total economic profit = TR – TC = (P-ATC) \times Q = BC \times AC = 2 \times 20 = 40 \text{ (the area of } APBC )

If a firm is receiving positive economic profits, the owners are receiving a return on their investment that exceeds what they could receive if their resources had been used in an alternative occupation. In this case, existing firms will stay in the market and new firms will enter the market. We will discuss the effects of this entry on price and output in more detail later.

2) Zero Economic Profit (Normal Profit)

If \( P = MC = \min ATC \), firm is earning zero economic profit, i.e., is earning normal profit (this is known as break-even point)

Total profit = (P – ATC) \times Q, \text{ But since } P = ATC \text{ then } (P-ATC) = 0 \Rightarrow \text{ total profit} = 0
3) **Loss Minimization and the Temporary Shutdown Decision**

- The short-run profit maximization rule does not mean that the firm is making profit. It just directs the firm to the best possible level of output given the existing market price and short run costs.
- As long as $P > ATC$, the firm is making economic profit.
- Suppose that $P < ATC$ at the level of output at which $MR = MC$. Will the firm continue operations? If the firm suffers a loss, what is the best action?
- Remember that: Profit = $(P – ATC) \times Q$, and that $ATC = AFC + AVC$
  Therefore, Profit = $(P – AFC - AVC) \times Q$
- Remember also that fixed costs must be paid even if output = 0. Thus, if the firm shuts down its operation it has to pay the fixed costs.
- To determine this, we have to compare the firm's loss if it stays in business with its loss if it shuts down.
- If the firm decides to shut down, its revenue will equal zero and its costs will equal its fixed costs. (Remember, fixed costs must be paid even if the firm shuts down.) Thus, the firm receives an economic loss equal to its fixed costs if it shuts down.
- The firm will stay in business in the short run even if it receives an economic loss as long as its loss is less than its fixed costs. This will occur if the revenue received by the firm is large enough to cover its variable costs and some of its fixed costs.
- In mathematical terms, this means that the firm will stay in business as long as $TR = P \times Q > TVC$
- Dividing both sides of the above expression by $Q$, we can write this condition in an alternative form. The firm will stay in business as long as $P > AVC$
- Consider the situation illustrated by the diagram below.
- In this case, losses are minimized in the short run at the level of output at which $MR = MC$. This occurs at an output level of $Q_L$. 
Since the level of average total cost (ATC) exceeds the market price (PL), this firm receives economic losses.

But as long as the price is greater than AVC this firm will choose to stay in business in the short run. If the firm were to shut down, it would lose its fixed costs. TFC = AFC * QL = ac * cd = the area of acde.

A comparison of the firm's losses if it shuts down (the area of acde) with its losses if it continues to operate in the short run (the area of PLbcd) indicates that this firm will receive lower losses if it decides to remain in business in the short run.

If the firm produce the amount of output Qs at price Ps, it is producing at the shut-down point where, P = MC = min AVC.

The shutdown point is the output and price at which the firm just covers its total variable cost. This point is where average variable cost is at its minimum. It is also the point at which the marginal cost curve crosses the average variable cost curve.

The loss of operation here is equal to the loss of shutting down (Loss = TFC).
Although firm is indifferent of producing or shutting down, many firms continue to produce hoping for price improvement as well as to keep customers from going to other producers, and to save the cost of maintenance when it starts re-operating in the future.

The minimum amount of output that the perfectly competitive firm could be produced is $Q_s$ where $P = \min AVC$ (shutdown point).

A firm should shut down only if the losses from continuing production exceeds fixed costs, i.e., a firm should shut down only if $P < AVC$ (or $TR < TVC$).

Therefore, shutdown the firm at any level of output where $P < AVC$. This possibility is illustrated in the diagram if $P < P_s$.

Note that a shutdown (a SR decision) does not necessarily mean a firm is exiting the business. Leaving the business is a LR decision.

In LR, of course, firms will leave the industry if economic losses are received (remember, there are no fixed costs in the long run.)
The Firm Short-run Supply Curve

✧ For a competitive firm, MC defines the lowest price a firm will accept for a given quantity of output.

✧ In this sense, the MC curve is the supply curve; it tells us how quantity supplied respond to price.

✧ At a price equal to minimum average variable cost—the shutdown price—the industry supply curve is perfectly elastic because some firms will produce the shutdown quantity and others will produce zero.

✧ Since the firm will shutdown if P falls below minimum AVC, the supply curve does not exist below min AVC.

✧ Therefore, the marginal cost curve, above the shutdown point (above the min AVC), is the short run supply curve for a competitive firm. In the figure above, supply curve starts at point "a" to point "b" and upward along the MC curve.

✧ The supply curve is upward sloping because of increasing MC. If more quantities needed to be produced price must increase to cover the rising MC.

✧ The market (or industry) supply curve is the sum of the marginal cost (individual supply) curves of all the firms.
THE FIRM LONG RUN DECISIONS: THE INVESTMENT DECISION

✧ In short-run equilibrium, a firm may earn an economic profit, normal profit, or incur an economic loss. Which of these states exists determines the further decisions the firm makes in the long run.

✧ In the long run, the firm may:
  o Enter or exit an industry
  o Change its plant size

✧ In making an investment decision, an entrepreneur treats all costs as variable.

LR COMPETITIVE PROCESS

✧ In the long run, new firms will enter the market if existing firms receive positive economic profits. Firms will leave the market if economic losses are realized.

✧ The following is the sequence of events common to a competitive market situation

✧ High prices and profits signal consumers' demand for more output. The existence of economic profit
  a. attract new firms to the industry
  b. encourage existing firms to expand their production

✧ The LR investment decision to enter this market or expand production is made on the basis of the relationship between P and ATC. The profit motive drives these investment decisions.

✧ Firms enter a market as long as P > ATC.

✧ If more firms enter an industry, the market supply will increase causing market supply curve to shift rightward and as a result, the price falls, the quantity increases.

✧ For the firm, when P↓ ⇒ Q↓ ⇒ profit↓.
However, as long as the economic profit continues to exist and as long as it is easy for existing producers to expand production and new firms to enter the market, market supply will increase more and more and price will fall more. Any short run equilibrium (where \( P = MC \)) will not last.

Throughout the process, producers experience great pressure to keep ahead of the profit squeeze by reducing costs, a pressure that frequently results in product and technological innovation.

When the price drops, due to the increase in supply, to the minimum of ATC, there are no longer economic profits and firms will not enter.

In the long equilibrium, if the market price is just equal to the minimum point on the ATC curve (where \( P = MR = MC = \text{min ATC} \)), the firm will receive zero economic profit (normal profit).

In this case, the owners of the firm are receiving a rate of return on all of their resources that is just equal to that which they could receive in any alternative employment (normal profit or average returns). When this occurs, there is no incentive to enter or to leave this market and the market price stabilizes.
The existence of economic loss moves the process in the opposite direction, i.e., firms who suffer economic losses in LR may shrink size or exit the industry ⇒ $S\downarrow$ ⇒ SC shifts leftward ⇒ $P\uparrow$ ⇒ firms that continue to produce will increase Q with the increase in P ⇒ their losses $\downarrow$ until their losses is eliminated and they earn normal profit.

In the above figure, if economic profits exist in an industry, more firms will enter the market. As they do, the market supply curve will shift to the right and will cause the market price to drop from $P_1$ to $P_2$ (part a). The lower market price, in turn, will reduce the output and profits of the typical firm. In part b, the firm's output falls from $Q_1$ to $Q_2$ to $Q_n$. This process will continue until the market reaches the LR equilibrium where $P = MC = \text{min LRATC}$.

**In the short run,** competitive firms strive for the rate of output at which $P = MC$. When they achieve that rate of output, they are in short run equilibrium. They have no incentive to change the rate of output produced with existing (fixed) plant and equipment.

**In the long run,** if the short run equilibrium is profitable ($P > ATC$), other firms will want to enter the industry. As they do, market price will fall until it reaches the level of $\text{min ATC}$. In this long run equilibrium, economic profits are zero and nobody wants to enter or exit the industry.
EXERCISE

Based on the above figure answer the following questions:

1. At P = 25,
   a. What is the right level of output? Why? Is there any profit? What type of profit?
   b. What is the rate of output that will maximize profit per unit? Why?
   c. What is the rate of output that will minimize the cost? Why?
   d. Is it a good decision to produce more than 35 units of output? Explain!
   e. Is producing less than 35 units of output considered a good decision? Explain!
f. The firm was selling 35 units at P = 25. If the firm wants to sell the 36th unit, what is the price of the 36th?

2. At P = 15, what is the output level? Is there any profit? What type of profit?
3. If P = 12, is there any profit? What is the right decision for the firm?
4. If P = 10, what is the right decision for the firm?
5. If P = 8, what is the right decision for the firm?
6. Assuming there is no shut down, what is the least amount of output that could be produced?
7. At point D (Q=35), find the area of TR, TC, TFC, TVC, and total profit.
8. How might technological improvement affect ATC, MC and Q?
9. Determine the firm 's demand and supply curve(s)
10. What are the price and the quantity that will prevail in the long run?