1 Profit Maximization

For perfect competition in a product market, we make some assumptions:

- Price taking: either individual firms or consumers cannot affect the price.
- Product homogeneity: product of all firms are perfect substitutes.
- Free entry and exit: no special cost to enter or exit the market.

Firms choose the level of output to maximize their profits. Profit equals total revenue minus total cost, namely

\[ \pi(q) = R(q) - C(q) = P(q)q - C(q). \]

To maximize the profit, the following condition must hold:

\[ \frac{d\pi(q)}{dq} = \frac{dR}{dq} - \frac{dC}{dq} = MR(q) - MC(q) = 0, \]

and thus

\[ MR(q) = MC(q). \]

Since

\[ R(q) = Pq, \]

we have

\[ MR(q) = \frac{dR(q)}{dq} = P, \]

and

\[ MR = AR. \]
thus

\[ MC(q) = P = MR = AR \]

is the maximization condition. Note that the condition is not sufficient. In Figure 1, if the price is \( P_2 \), \( q_2 \) and \( q_3 \) both satisfy the condition, but only \( q_3 \) maximizes the profit.

![Figure 1: Profit Maximization.](image)

### 2 Short Run Supply

Assume the firm has production costs shown in Figure 2, let us discuss its behavior under different prices.

- When \( P = P_1 \), the firm is making profits, so it will continue to produce;
- When \( P = P_2 \), the firm has losses but still continues to produce, because if it shuts down, the profit is \(-FC\), and if continuing to produce, the profit is \( R - TVC - FC > -FC \).
- Since \( R < SVC \), when \( P = P_3 \), the profit if the firm shuts down, \(-FC\), is more than the profit if it continues, \( R - TVC - FC \), so it will shut down.

When the firm produces, it chooses the output level where \( MC(q) = P \). Therefore, the firm’s supply curve when it produces is just the part of \( MC \) above \( TVC \). When \( P < AVC \), the firm shuts down and \( q = 0 \).

We can derive market supply from an individual firm’s supply (see Figure 3). Define elasticity of market supply as follows:

\[ E_S = \frac{dQ/Q}{dP/P}. \]

Figure 4 and 5 stand for inelastic and elastic supply curves, respectively.
2 Short Run Supply

Figure 2: Individual Firm’s Supply in Short Run.

Figure 3: Market Supply in Short Run.
Figure 4: Inelastic Market Supply Curve.

Figure 5: Elastic Market Supply Curve.
2 Short Run Supply

Figure 6: Perfectly Inelastic Market Supply Curve.

Figure 7: Perfectly Elastic Market Supply Curve.
Similarly, we have perfectly inelastic market supply (see Figure 6) and perfectly elastic market supply (see Figure 7).

Perfectly elastic market supply happens when

\[ MC = \text{const.} \]

3 Producer Surplus

Producer Surplus is the difference between the firm’s revenue and the sum of the total variable cost of producing \( q \) (see Figure 8):

\[ PS = R - TVC = R - TVC - FC + FC = \text{Profit} + FC. \]

Thus, producer surplus is the sum of profit and fixed cost.

Figure 8: Producer Surplus.