Short-run Producer Equilibrium Cheatsheet

Rule 1 (Price-taking rule): Firms take prices as given under perfect competition

$$P = MR = AR$$

Intuition: *$P = MR = \frac{\Delta TR}{\Delta q}$ means for each additional unit of output q, the firm earns P. $P = AR = \frac{TR}{q}$ means for a given amount of output q, the firm earns P for each unit on average. Remember $TR = P \times q$.*

Rule 2 (Optimal output rule): Firms want to produce a certain amount of output to maximize profit. Combined with Rule 1:

$$P = MR = MC$$

Intuition: *If $MC = \frac{\Delta TC}{\Delta q} < P$, then the firm can increase revenue by increasing q because the gains P from each additional unit of output is less than the cost MC. Vice versa if $MC > P$, the firm can increase revenue by decreasing q. So, the optimal point is when $P = MC$. You can check by drawing a graph.*

Rule 3 (Shutdown rule): In the short-run, firms will only produce positive output if the total revenue is at least covers the total variable cost.

$$TR > TVC \implies \frac{TR}{q} > \frac{TVC}{q} \implies P > AVC$$

The min. price for a firm to produce positive amounts is $P > \min AVC$ (**Shutdown point)**.

Intuition: *In the short-run, the TFC is fixed, so even if a firm produces nothing, it will have to pay fixed cost. Suppose at some positive output level, the firm can earn more than enough to its variable costs. Then, the leftover earnings can be used to cover some or all of fixed costs, so it's more worthwhile to producing some positive amount than nothing.*

Rule 4 (Profits): Firm profits are given by

$$\pi = TR - TC = (AR - AC) \times q$$

- Firm gains when $\pi > 0$ i.e. $TR > TC$, or $AR > AC$
- Firm loses when $\pi < 0$ i.e. $TR < TC$, or $AR < AC$
- Firm breaks even when $\pi = 0$ i.e. $TR = TC$, or $AR = AC$

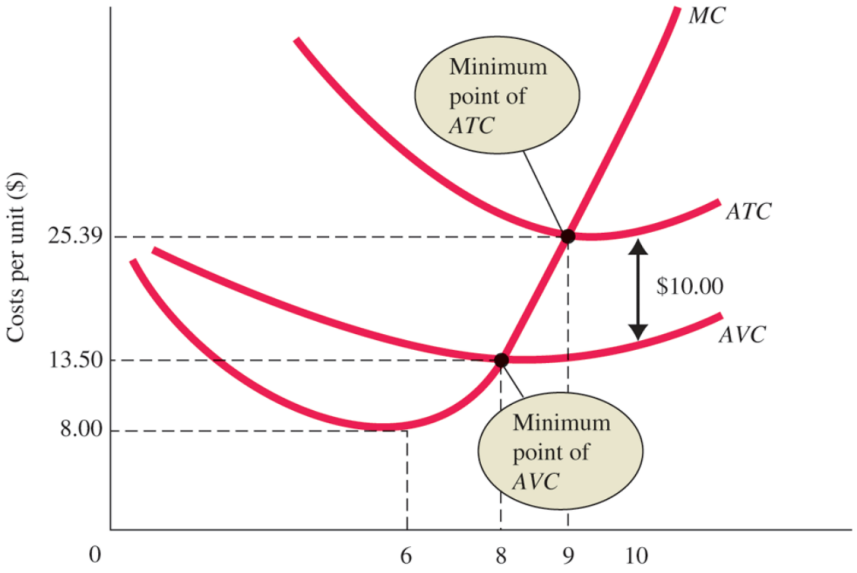
Rule 5 (Short-run supply): Under perfect competition, a firm's short-run supply is the same as the MC curve, except when price is below the shutdown point:

$$P = MC$$

Intuition: *Given any price P, the intersection of P and MC gives us the optimal output (by Rule 2).*

Rule 6 (MC, ATC, AVC): MC always intersects with ATC at the minimum point of ATC, and with AVC at the minimum point of AVC. (Figure below from textbook Pg. 177)

Figure 8.8 Average Total Cost = Average Variable Cost + Average Fixed Cost



Useful Definitions

- We denote q as the firm output and Q as the industry or market level output.
- We often use AC and ATC interchangeably.
- TVC and VC, and TFC and FC are often used interchangeably (unless several different FCs or VCs are specified, then TVC is the sum of all VCs, TFC is the sum of all FCs).

Useful Definitions

- $TC = TFC + TVC$
- $ATC = AC = TC/q$
- $AFC = TFC/q$
- $AVC = TVC/q$
- $MC = \Delta TC/\Delta q$