Firm Supply

- Demand Curve Facing Competitive Firm
- Supply Decision of a Competitive Firm
- Producer’s Surplus and Profits
- Long-Run
The Demand Curve Facing a Competitive Firm

Diagram showing the demand curve with price ($p$) on the vertical axis and quantity ($y$) on the horizontal axis. The market price ($p^*$) is marked on the price axis.
Problem of a competitive firm:

\[
\max_{y} py - c(y)
\]
Revenues, Costs, and Profits
Maximum Profits

\[ p \]

\[ c(y) \]

\[ py \]
Firm maximizes:

$$\max_y py - c(y)$$

**Necessary** condition for optimal choice:

$$p = \frac{\partial c(y)}{\partial y} = MC(y)$$
An Example

- **Short-run cost function:**

  \[ c(y) = y^2 + 1 \]

- **Marginal cost function:**

  \[ MC(y) = 2y \]
An Example

- Average variable costs:

\[ AVC(y) = \frac{y^2}{y} = y \]

- Average costs:

\[ AC(y) = \frac{y^2}{y} + \frac{1}{y} = y + \frac{1}{y} \]
An Example

**Profit maximization:**

\[
\max_y py - \left(y^2 + 1\right)
\]

**Necessary condition:**

\[p = 2y\]
An Example

\[ p \]

\[ AC \]

\[ MC \]

\[ AVC \]

0 1 2
An Example: Profits
Producer’s Surplus

- Producer’s surplus = Area below price above supply curve

- Alternatively: $py^*$ — below supply curve

where area below supply curve (MC):

$$c_v(y^*)$$
An Example: Producer’s Surplus
An Example: Producer’s Surplus

\[ p \quad AC \quad MC \quad AVC \]

\[ p^* \]

\[ AVC(y^*) \]

\[ 0 \quad y^* \quad y \]
Producer’s Surplus and Profits

Producer’s surplus:

\[ py^* - c_v(y^*) \]

Profits:

\[ py^* - c_v(y^*) - F \]
An Example: Producer’s Surplus and Profits

\[ p^* \]

\[ AC(y^*) \]

\[ AVC(y^*) \]
An Example

Output:

\[ y^* = \frac{p^*}{2} \]

Profits:

\[ \Pi = p y^* - \left( y^{*2} + 1 \right) = \frac{\left( p^* \right)^2}{4} - 1 \]
An Example

Profits:

\[ \Pi = \frac{(p^*)^2}{4} - 1 \]

Producer’s surplus:

\[ \frac{1}{2} p^* \left( \frac{p^*}{2} \right) = \frac{(p^*)^2}{4} \]
One Exception: $y_1$ or $y_2$?
A Second Exception: Shutdown!

- Profits if firm produces:
  \[ \Pi = p y^* - c_v(y^*) - F \]

- Profits if firm does not produce:
  \[ \Pi = -F \]

- Producing is better if:
  \[ p y^* - c_v(y^*) > 0 \]
A Second Exception: Shutdown!

- Producing is better if:

\[ py^* - c_v(y^*) > 0 \]

- Rearrange. Produce only if:

\[ p > \frac{c_v(y^*)}{y^*} \]
Shutdown

$AC, MC, AVC$
The Firm’s Supply Curve
Long and Short Run Supply in Consultant Firm Example

\[ MC^S(y) \]

\[ MC^L(y) \]

\[ p^* \]

\[ p^{**} \]

\[ y_L^{**} \]

\[ y_S^{**} \]
Shutdown in the Short-Run and in the Long-Run

• In the short-run, the shutdown condition is:

\[ p < \frac{c^v(y^*)}{y^*} = AVC(y^*) \]

• In the long-run, the shutdown condition is:

\[ p < \frac{c(y^*)}{y^*} = AC(y^*) \]