# Perfect competition

- Homogenous products
  → everyone produces exactly the same $y$
- "Many" firms
  - actions of individual firms don't affect the market as a whole
- Free entry / free exit
  - firms can costlessly enter and exit the market
- Perfect information
  - Everyone can observe all prices simultaneously

→ In competitive markets, there is only one market price

→ Firms are "price takers"
  - They don't have any power to choose a price

## Profits

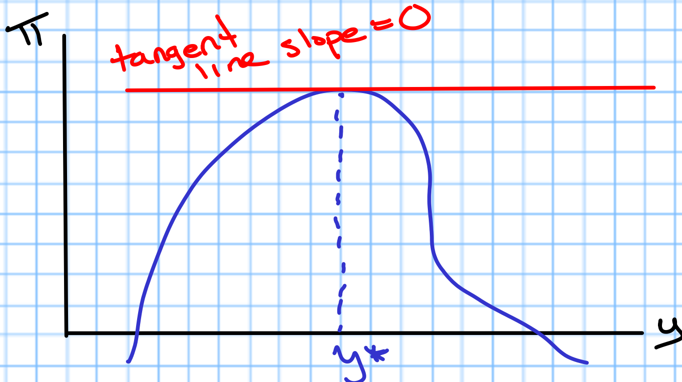
$\pi$ = revenue - cost

Revenue: $R(y) = py$

Costs: $C(y)$

$\uparrow$ cost-minimization

$$\pi(y) = R(y) - C(y)$$




Profits are maximized when:

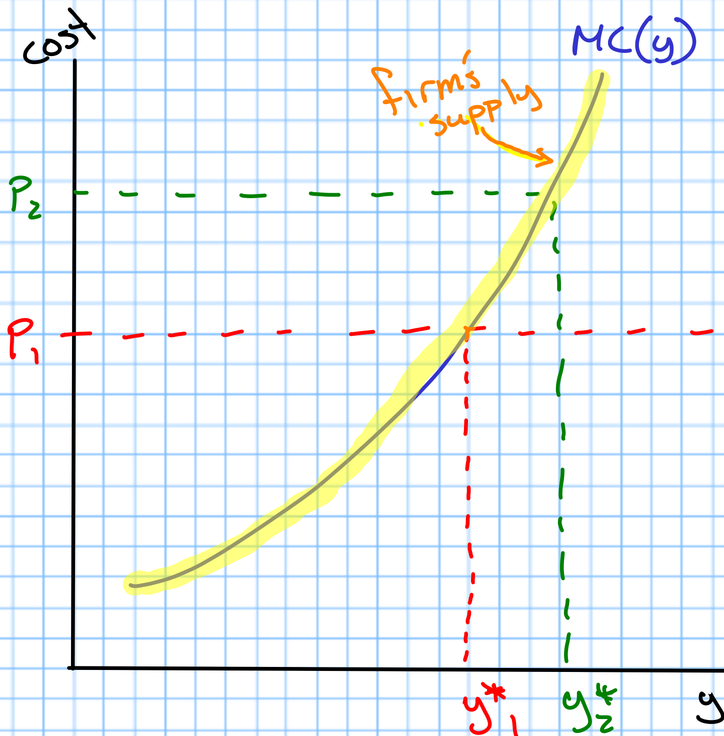
$$\frac{d\pi}{dy} = 0$$

$$\pi(y) = R(y) - C(y)$$

$$\frac{d\pi}{dy} = \underbrace{\frac{dR(y)}{dy}}_{P} - \underbrace{\frac{dC(y)}{dy}}_{MC(y)}$$

$$P = MC(y)$$

Marginal revenue = marginal cost




In competitive markets, each firm faces a horizontal demand curve (changes in supply have no effect on price)

## Short-run profit max

- Fixed K
- Fixed number of firms

$c(y) = F + c_v(y)$

- Suppose $y = 0$ (the firm has shut down in the short run)

$$\pi(y) = p \cdot y - c(y)$$
$$\pi(y) = p \cdot y - (F + c_v(y))$$
$$\pi(0) = 0 - (F + 0)$$
$$\pi(0) = -F$$

If the firm shuts down, they earn a profit of $-F$

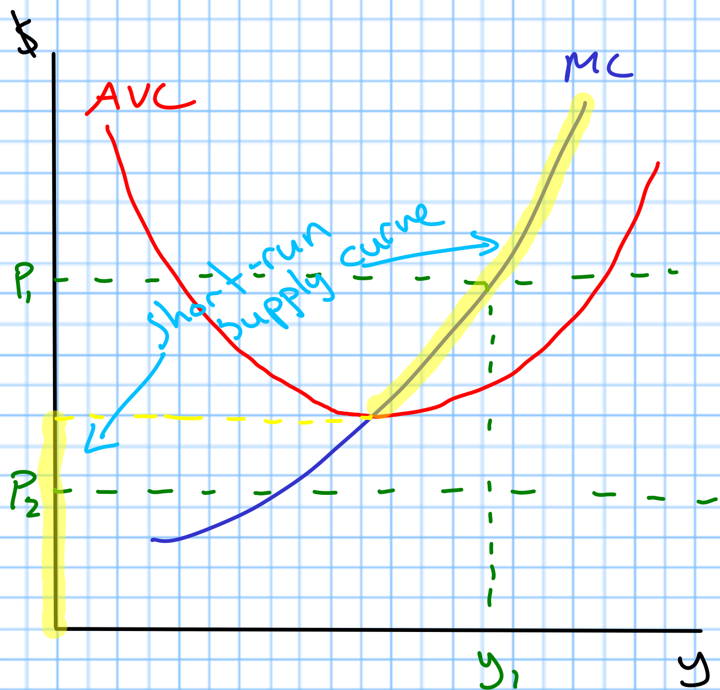
- Question: when is it worth it for a firm to <u>not</u> shut down?

Stay open if $\pi(y) > -F$

$$p \cdot y - (F + c_v(y)) > -F$$

$$p \cdot y \cancel{-F} - c_v(y) > \cancel{-F}$$
$$p \cdot y - c_v(y) > 0$$
$$p \cdot y > c_v(y)$$
$$p > \frac{c_v(y)}{y}$$

$$p > AVC$$




## Long-run $\pi$-max

- Firms can adjust K and L → leave the market if they wish

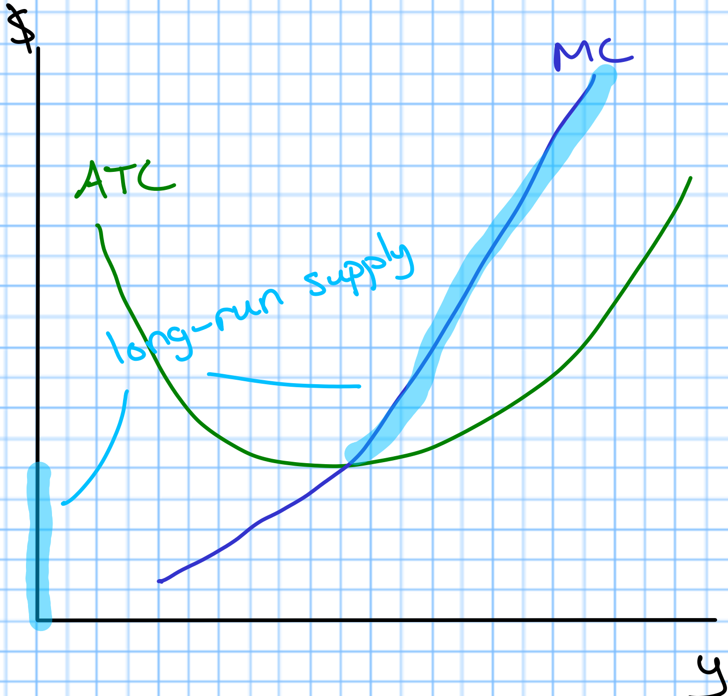
$\pi(0) = 0$

$$py - c(y) = 0$$

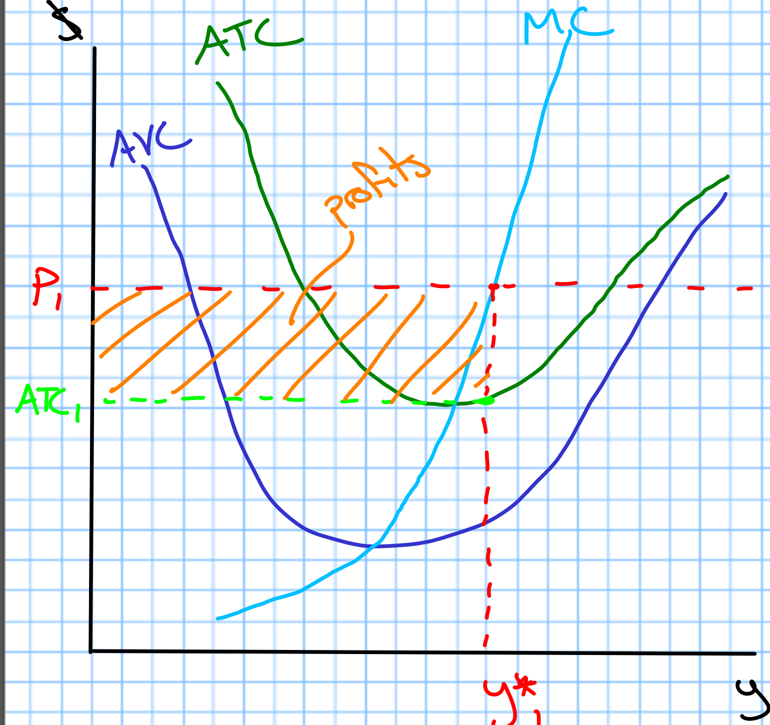
$$py = c(y)$$

$$p = \frac{c(y)}{y}$$

Firm exits the market if $p < ATC$



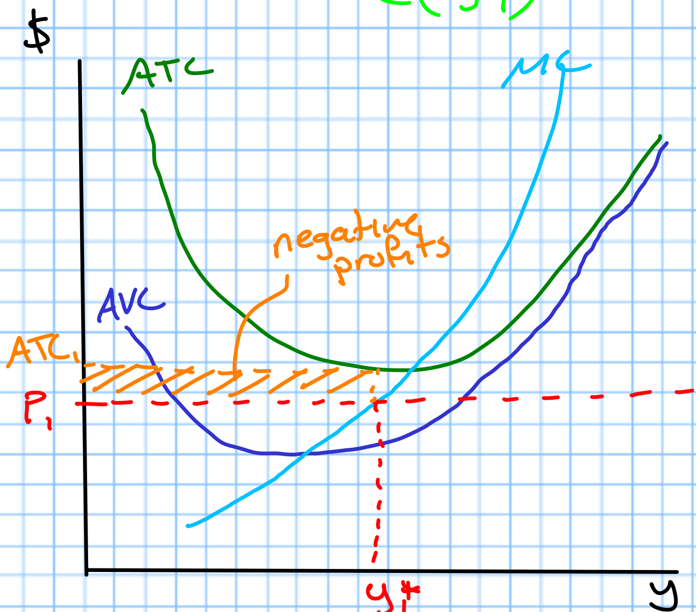
$
MC
ATC
long-run supply
y

$
ATC
MC
AVC
profits
P1
ATC1
y*1
y

$$ATC_1 \cdot y_1^* = \frac{c(y_1^*)}{\cancel{y_1^*}} \cdot \cancel{y_1^*}$$

$$= c(y_1^*)$$



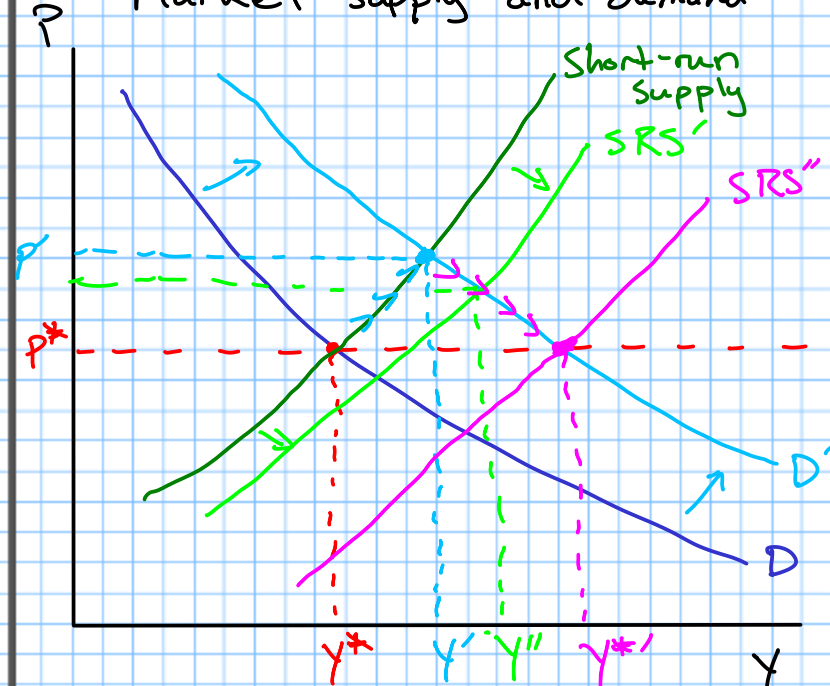

Result:

- In the long run, firms exit the market when p is less than ATC ($\pi < 0$)
- In the short run, firms may be willing to incur negative profits

# Long-run Equilibrium

- Suppose firm is producing $y^*$ output
  $\pi(y^*) > 0$
- Free entry/exit
- More firms enter the market
- Market supply increases
  - $P \downarrow$
  - $\pi \downarrow$
- Long run profits in competitive markets:
  $\pi(y) = 0$

## Market supply and demand

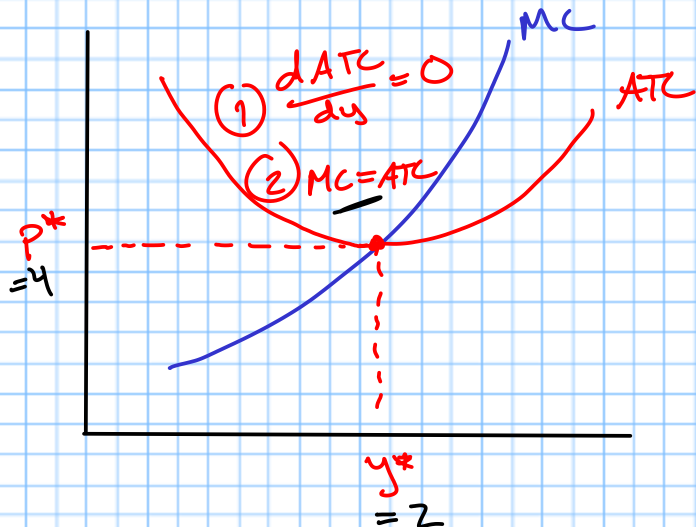



Big Y: market quantity
p*: zero-profit price

## Example

$$c(y) = 2y^3 - 8y^2 + 12y$$

Find LR equilibrium price




(1): $\frac{dATC}{dy} = 0$

$$ATC = \frac{c(y)}{y}$$

$$= \frac{2y^3 - 8y^2 + 12y}{y}$$

$$= \frac{2y^3}{y} - \frac{8y^2}{y} + \frac{12y}{y}$$

$$= 2y^2 - 8y + 12$$

$$\frac{dATC}{dy} = 4y - 8 = 0$$

$$= 4y = 8$$

$$y = 2$$

$$p^* = ATC(2)$$
$$= 2(2)^2 - 8(2) + 12$$
$$= 8 - 16 + 12$$
$$= 4$$

(2) $ATC(y^*) = MC(y^*)$
$$2y^2 - 8y + \cancel{12} = 6y^2 - 16y + \cancel{12}$$
$$8y = 4y^2$$
$$2y = y^2$$
$$2 = y^*$$

$$p^* = MC(y^*)$$
$$= 6(2)^2 - 16(2) + 12$$
$$24 - 32 + 12 = 4$$

$$\pi = p \cdot y - c(y)$$
$$= 4 \cdot 2 - c(2)$$
$$= 8 - \left(2(2)^3 - 8 \cdot 2^2 + 12(2)\right)$$
$$= 8 - (16 - 32 + 24)$$
$$= 8 - 8$$
$$= 0$$