Profit Maximization
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Shutting Down
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LR Profit
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Intro to Economic Analysis: Microeconomics
EC 201 - Day 17 Slides – Set 1

Connor Wiegand

Department of Economics - University of Oregon

22 November 2021

Logistics

▶ Homework 7 due next <u>Monday</u> (Nov 29) at 11:59pm
  • It's a little long, get started early
▶ Last News Assignments posted, due <u>this</u> Wednesday (November 24th) at 11:59pm

Recall

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▶ <u>All</u> firms choose to produce another unit so long as MR exceeds MC. This means they will produce up until

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▶ <u>All</u> firms choose to produce another unit so long as MR exceeds MC. This means they will produce up until

$$\boxed{MR = MC}$$

▶ Since the perfectly competitive (PC) has no affect on the price, their marginal revenue is always equal to the price:

$$MR = P$$

Recall

▶ Therefore, the PC firm always produces where

$$\boxed{P = MC}$$

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▶ Mind you that P is a constant (horizontal line), while MC is a function of Q

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▶ If you like graphics, I made a simple desmos plot here
  - P is in black, MC is in red, profit is in green
  - Adjusting the price, we see that the Q value where P equals MC is the same Q value that maximizes the profit function (for $Q > 0$)

Optimally Producing PC Firm

▶ How much does the perfectly competitive firm produce?

Output	P	TR	TC	π	MC	$\Delta\pi$
0	9	0	8	-8	–	–
1	9	9	9	0	1	8
2	9	18	12	6	3	6
3	9	27	17	10	5	4
4	9	36	24	12	7	2
5	9	45	33	12	9	0
6	9	54	44	10	11	-2
7	9	63	57	6	13	-4
8	9	72	72	0	15	-6

Optimally Producing PC Firm

▶ Find where $P = MC$: the firm makes 5 units for a total profit of $12

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▶ Note the change in profit at the optimum

Another Way to Write Profit

▶ Recall that profit for the firm is given by $\pi = TR - TC$

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  - $P > ATC \implies \pi > 0$
  - $P = ATC \implies \pi = 0$
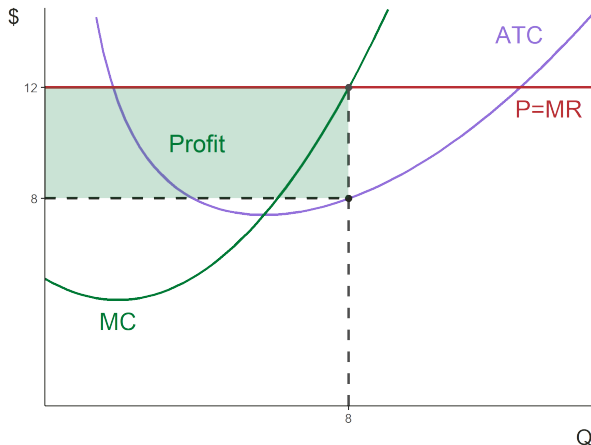 - $P < ATC \implies \pi < 0$

Visualizing Profit for a PC Firm

► Recall our example diagram
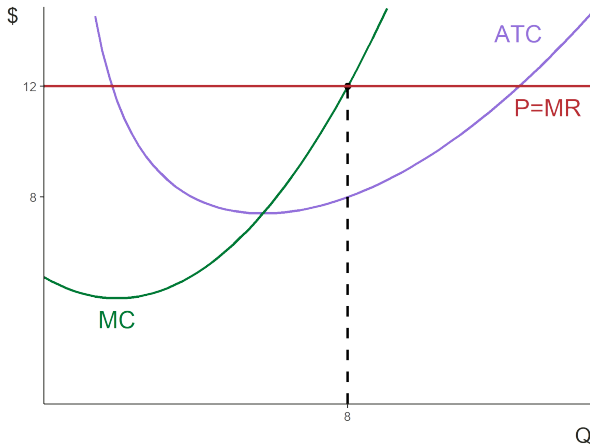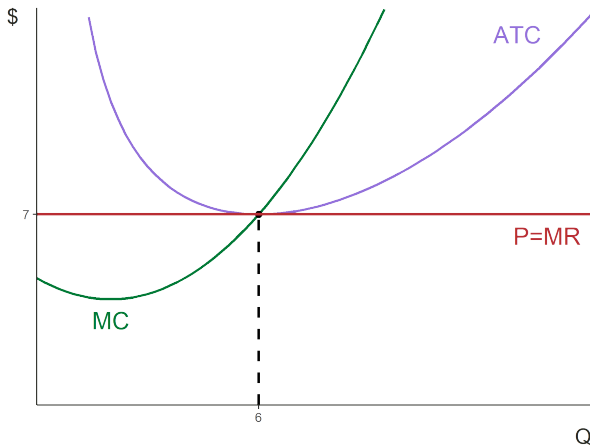
Visualizing Positive Profit for a PC Firm

▶ Since $\pi = (P - ATC)\, Q$, profit is given by the following box
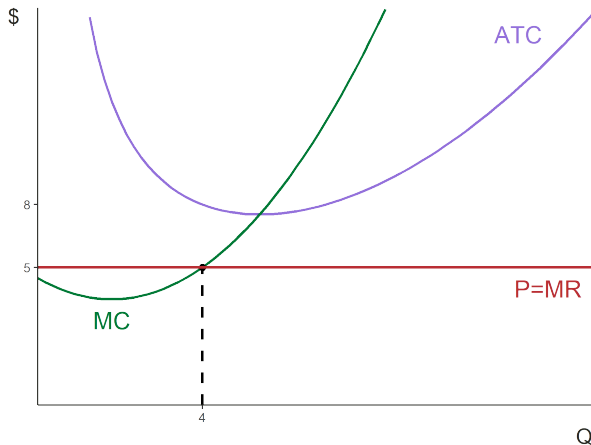

In this case, $\pi = 8\,(12 - 8) = \$32$

Visualizing Zero Profit for a PC Firm

▶ In this case, we produce at $P = MC$, and this induces ATC to equal P, so we get a profit of 0:

Profit Maximization
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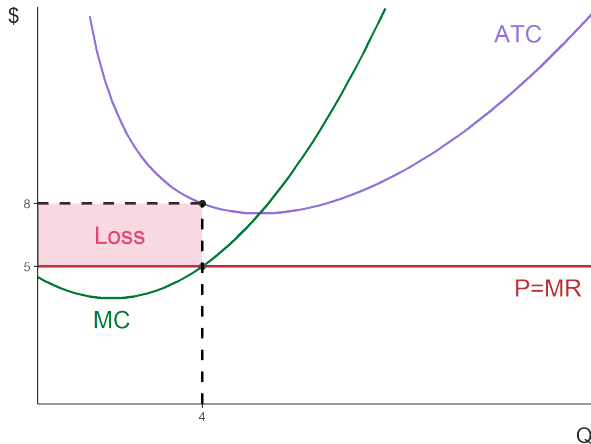
Shutting Down
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LR Profit
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Visualizing Negative Profit for a PC Firm

▶ In this case, we produce at $P = MC$, and this induces ATC to be below P, so we will make negative profit:

Profit Maximization
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Shutting Down
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LR Profit
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Visualizing Negative Profit for a PC Firm

▶ Specifically, we make $\pi = 4(5 - 8) = -12$

Profit Maximization
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Shutting Down
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LR Profit
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Visualizing Profit for a PC Firm

▶ Note: Based on the shape on MC, we can see that if $MC < MR$, the firm should increase production. If $MC > MR$, the firm should decrease production. If $MR = MC$, the firm should produce at that level
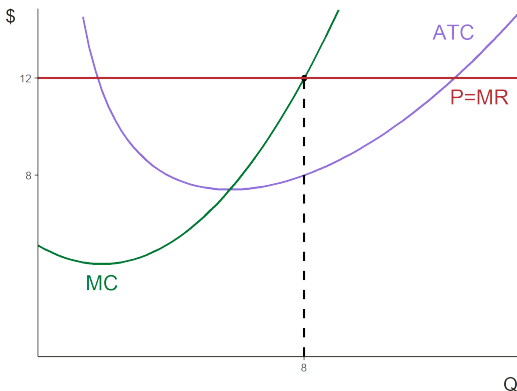
Should I Stay in Business?

▶ Suppose I started a restaurant one year ago, with

Should I Stay in Business?

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- Monthly revenue of $10,000

Should I Stay in Business?

▶ Suppose I started a restaurant one year ago, with
  • Monthly revenue of $10,000$
  • Monthly ingredients costing of $2,000$ and monthly labor costing $5,000$

Should I Stay in Business?

▶ Suppose I started a restaurant one year ago, with

- Monthly revenue of $10, 000
- Monthly ingredients costing of $2, 000 and monthly labor costing $5, 000
- Fixed cost $120, 000 to start up the business

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- Monthly revenue of $10, 000
- Monthly ingredients costing of $2, 000 and monthly labor costing $5, 000
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▶ How much yearly profit am I making?

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- Monthly revenue of $10,000$
- Monthly ingredients costing of $2,000$ and monthly labor costing $5,000$
- Fixed cost $120,000$ to start up the business

▶ How much yearly profit am I making?
- $\pi = (12)\,10k - (12)\,7k - 120k = -84k$

Should I Stay in Business?

▶ Suppose I started a restaurant one year ago, with

- Monthly revenue of $10,000$
- Monthly ingredients costing of $2,000$ and monthly labor costing $5,000$
- Fixed cost $120,000$ to start up the business

▶ How much yearly profit am I making?

- $\pi = (12) \, 10k - (12) \, 7k - 120k = -84k$

▶ I lost $84,000$ this year! Should I shut down!?

Should I Stay in Business?

- No

Profit Maximization
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Shutting Down
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LR Profit
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Should I Stay in Business?

▶ No

- I am making $10k - 7k = \$3k$ every month, discounting the startup costs of my business

Should I Stay in Business?

▶ No
  - I am making $10k - 7k = \$3k$ every month, discounting the startup costs of my business
  - Therefore, I am making $\$36k$ a year. In less than 4 years, I will have paid off my startup costs and will be making positive profit

Profit Maximization
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Shutting Down
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LR Profit
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Should this PC Firm Shut Down?

▶ This firm is earning negative profit. Should they shut down?

Should this PC Firm Shut Down?

▶ No!

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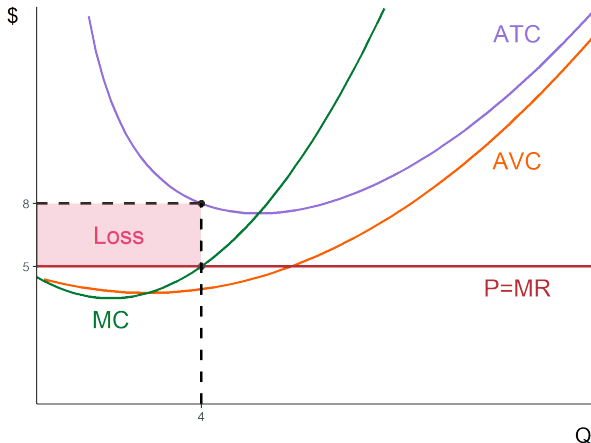
Should this PC Firm Shut Down?

▶ No!

- This is the same story that I just told, visually (and with different numbers)

Profit Maximization
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Shutting Down
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Shutdown Condition in the Short Run

▶ So when should I shut down?

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- That is, as long as my average total revenue is greater than or equal to my average variable cost, I shouldn't shut down

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- Note that average revenue is equal to $AR = \frac{TR}{Q} = \frac{P \cdot Q}{Q} = P$

Shutting Down Condition in the Short Run

▶ So when should I shut down?

- In the short run, I should stay in business as long as I cover my variable costs *on average*
- That is, as long as my <u>average</u> total revenue is greater than or equal to my <u>average</u> variable cost, I shouldn't shut down
- Note that average revenue is equal to $AR = \frac{TR}{Q} = \frac{P \cdot Q}{Q} = P$
- Therefore, I should stay in business so long as the price exceeds AVC

Shutdown Condition in the Short Run

▶ So when should I shut down?

  • In the short run, I should stay in business as long as I cover my variable costs *on average*
  • That is, as long as my <u>average</u> total revenue is greater than or equal to my <u>average</u> variable cost, I shouldn't shut down
  • Note that average revenue is equal to $AR = \frac{TR}{Q} = \frac{P \cdot Q}{Q} = P$
  • Therefore, I should stay in business so long as the price exceeds AVC

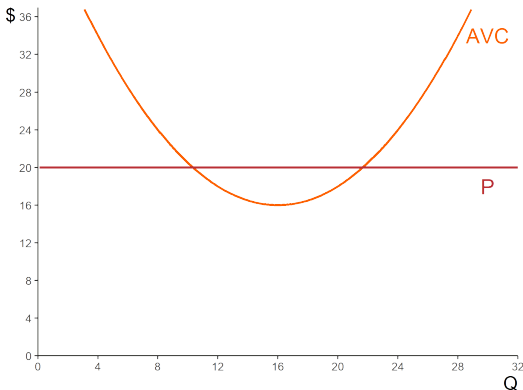▶ Conclusion: in the short run, the firm will shut down as long as

$$P > \min{(AVC)}$$

where the $\min{(AVC)}$ is the minimum value that AVC attains for $Q > 0$ (i.e., in the positive quadrant)

18/33

P and AVC

▶ The book says shutdown when $P < AVC$

Profit Maximization
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Shutting Down
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LR Profit
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P and AVC

▶ The book says shutdown when $P < AVC$

▶ But P is a horizontal line, and AVC is a parabola:

P and AVC

▶ The book says shutdown when $P < AVC$

▶ But P is a horizontal line, and AVC is a parabola:

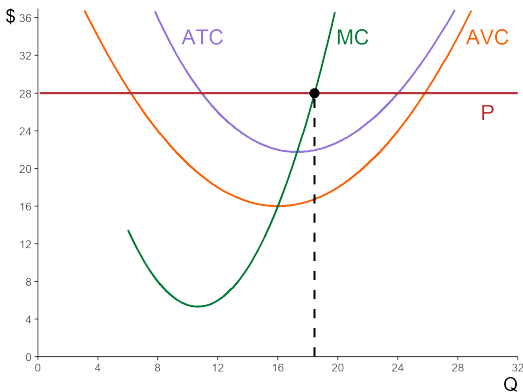▶ There are many places where $P > AVC$, and many where $P < AVC$

Profit Maximization
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Shutting Down
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LR Profit
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Precise Shutdown Condition

▶ More precisely, we should shut down when $P < \min(AVC)$; i.e., when the
P line is completely below AVC

Profit Maximization
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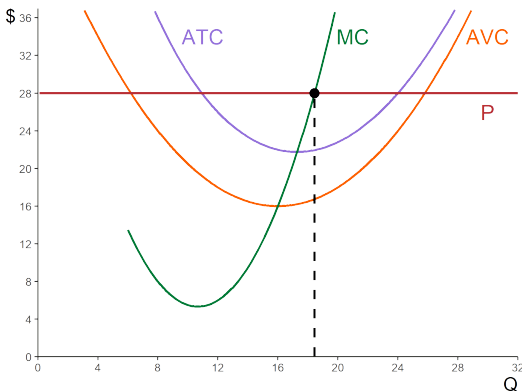Shutting Down
○○○○○○○●○○○○○○○○
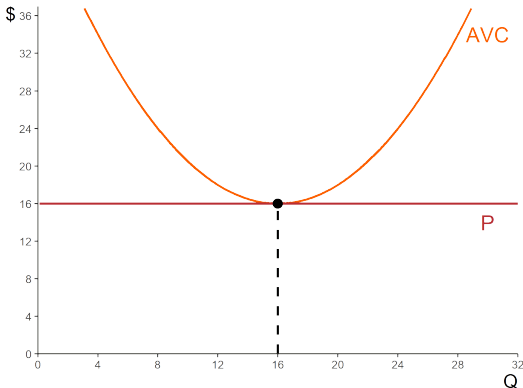
LR Profit
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Should We Shutdown 1

▶ Should this firm shut down? Are they making profit?
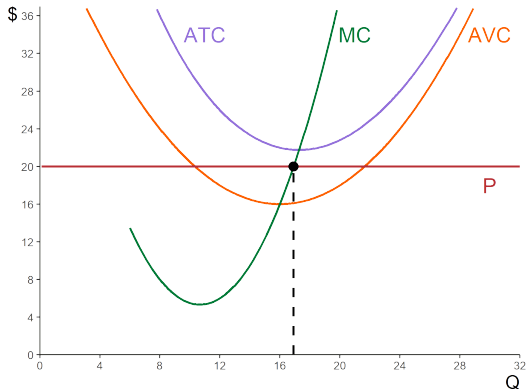
Should We Shutdown 1

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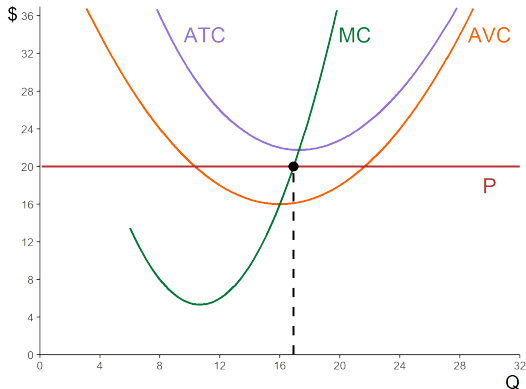▶ No, they are making positive profit

Should We Shutdown 2

▶ Should this firm shut down? Are they making profit?

Profit Maximization
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Shutting Down
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LR Profit
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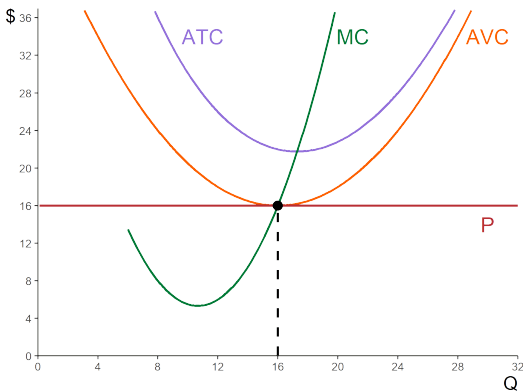
Should We Shutdown 2

▶ Should this firm shut down? Are they making profit?

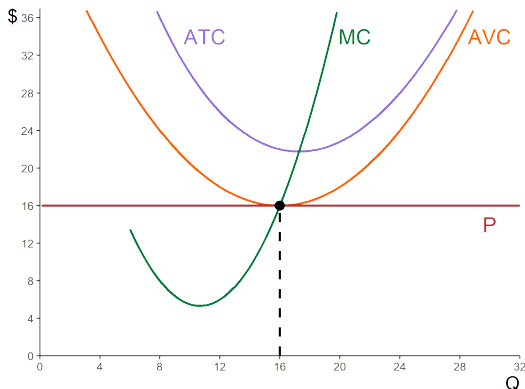▶ No, they are making negative profit but covering their variable costs on average

Should We Shutdown 3

▶ Should this firm shut down? Are they making profit?

Profit Maximization
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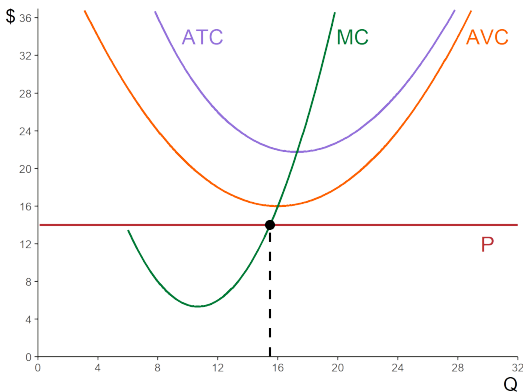
LR Profit
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Should We Shutdown 3

▶ Should this firm shut down? Are they making profit?

▶ Yes/no, they are perfectly breaking even on their variable costs

Should We Shutdown 4

▶ Should this firm shut down? Are they making profit?

Profit Maximization
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Shutting Down
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LR Profit
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Should We Shutdown 4

▶ Should this firm shut down? Are they making profit?

▶ Yes, they are not covering their variable costs on average
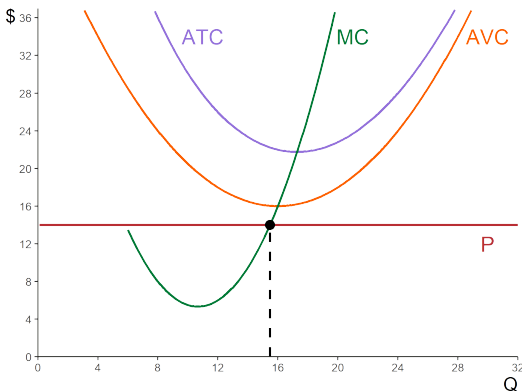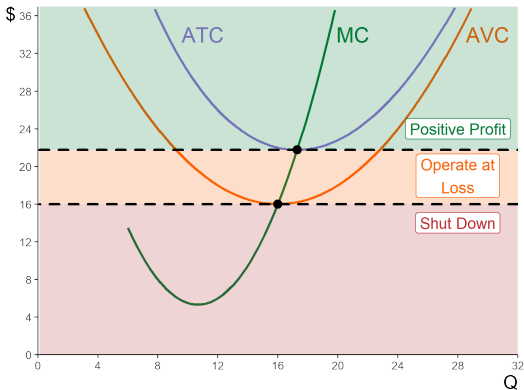
Full Shutdown Picture

▶ This summarizes the full shutdown picture

Fun Fact

▶ This may be worth noting, but is not something I need you to memorize

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  - If TC is quadratic, MC and AVC are linear

Profit Maximization
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LR Profit
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Fun Fact

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  • If TC is quadratic, MC and AVC are linear
  • If AVC and MC are linear, then the firm will never shut down (more
    precisely, their shutdown condition will happen exactly when $Q = 0$)

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▶ Example: suppose

- TC is given by $Q^2 + 6Q + 10$

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- MC is given by $2Q + 6$

Fun Fact

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▶ Example: suppose

- TC is given by $Q^2 + 6Q + 10$
- MC is given by $2Q + 6$
- AVC is given by $Q + 6$

▶ Let's graph MC and AVC and see what they look like

Profit Maximization
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Shutting Down
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LR Profit
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Fun Fact, Visualized

▶ The following firm should shut down when $P \leq 6$, but at this point, they would already be producing $Q \leq 0$ (i.e. $Q = 0$)
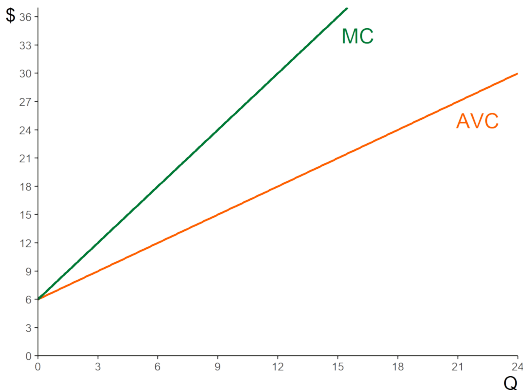
Shutting Down In the Long Run

- ▶ Recall: what are fixed costs in the long run?

Profit Maximization
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Shutting Down
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LR Profit
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Shutting Down In the Long Run

▶ Recall: what are fixed costs in the long run?

- There aren't any

Profit Maximization
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Shutting Down In the Long Run

▶ Recall: what are fixed costs in the long run?
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▶ In the long run, AVC=ATC, so when should we shut down?

Profit Maximization
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Shutting Down
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LR Profit
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Shutting Down In the Long Run

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 • When $P < \min(ATC)$ (specifically LRATC)

Shutting Down In the Long Run

▶ Recall: what are fixed costs in the long run?
  • There aren't any
▶ In the long run, AVC=ATC, so when should we shut down?
  • When $P < \min(ATC)$ (specifically LRATC)
▶ Idea: In the long run, when you are given full flexibility of all factors, you aren't covering your costs on average, you should leave the market

Profit Maximization
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Shutting Down
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LR Profit
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Shutting Down In the Long Run

▶ Here is the picture in the long run:

Profit Maximization
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Shutting Down
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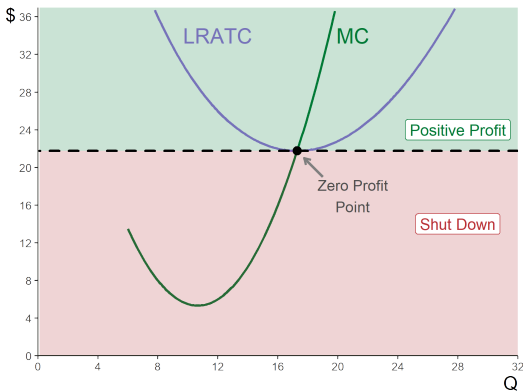
LR Profit
○○○○

Shutting Down In the Long Run

▶ Here is the picture in the long run:
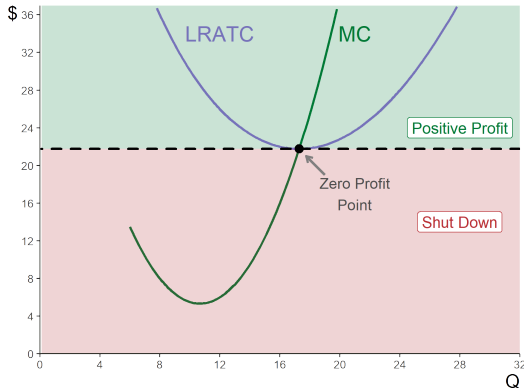
▶ Note: the zero profit point is also known as the break-even point

What Happens When Firms Make Profits

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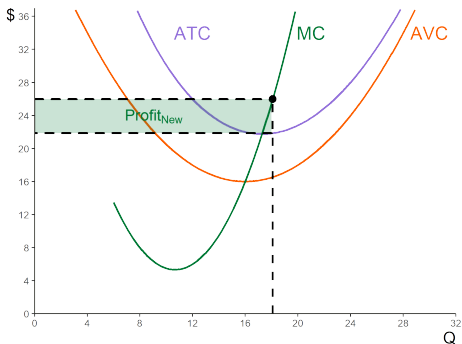
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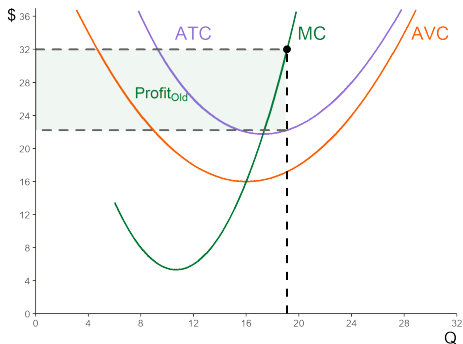
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▶ How does a downward movement of price affect a PC firm's profits?

Profit Maximization
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LR Profit
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How $P \downarrow$ Affects a PC Firm's Profits

▶ A downward movement in price decreases a PC firm's profits:

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EC 201
Connor Wiegand

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▶ Summary

  • In the short run, firms can make positive or negative profits, and may stay in the market with negative profits if they are covering their variable costs
  • In the long run, firms in a PC market make zero profit: positive SR profits cause more firms to enter, driving down the price; negative profits eventually (in the LR) cause firms to leave, driving up the price