Costs – Types
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Costs – Drawing
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Costs – Time Horizon
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Perfectly Competitive Markets
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Intro to Economic Analysis: Microeconomics
EC 201 - Day 16 Slides

Connor Wiegand

Department of Economics - University of Oregon

17 November 2021

Logistics

- ▶ Homework 6 due this Saturday at 11:59pm
- ▶ Last News Assignments posted, due a week from today (November 24th) at 11:59pm

Recall

▶ There are two major types of costs: <u>fixed costs</u> and <u>variable costs</u>

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[1] Usually

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- **<u>Fixed costs</u>** do not change with quantity produced[1]
- **<u>Variable costs</u>** vary with the quantity being produced by the firm
- The sum of fixed costs (FC) and variable costs (VC) is total cost (TC):

$$TC = FC + VC$$

---

[1] Usually

Average Costs and Marginal Cost

▶ For each of FC, VC, and TC, we can define an *average* cost by dividing by
  Q (output):

$$AFC = \frac{FC}{Q} \qquad AVC = \frac{VC}{Q} \qquad ATC = \frac{TC}{Q}$$

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▶ In addition to these costs, we will define the **marginal cost** for now to be the change in total cost from making an additional unit. Mathematically this looks like

$$MC = \frac{\Delta TC}{\Delta Q}$$

where ΔQ is often equal to 1

Example Cost Table

▶ Fill in the following cost table

Output	FC	VC	TC	MC	AFC	AVC	ATC
0	100		100				
1	100	4					
2	100	16	116				
3	100	36					
4	100	64					
5	100		200				
6	100		244				
7	100		296				
8	100	256					
9	100	324					
10	100		500				

Example Cost Table

▶ Fill in the following cost table

Output	FC	VC	TC	MC	AFC	AVC	ATC
0	100	0	100	–	–	–	–
1	100	4	104	4	100	4	104
2	100	16	116	12	50	8	58
3	100	36	136	20	33.3	12	45.3
4	100	64	164	28	25	16	41
5	100	100	200	36	20	20	40
6	100	144	244	44	16.6	24	244/6
7	100	196	296	52	14.2	196/7	296/7
8	100	256	356	60	12.5	256/8	356/8
9	100	324	424	68	11.1	324/9	424/9
10	100	400	500	76	10	40	50

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Drawing Cost Curves

▶ So what do these things normally look like?

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Drawing Cost Curves

▶ So what do these things normally look like?

▶ Generally, we care about drawing AVC, ATC, FC (sometimes AFC) and MC

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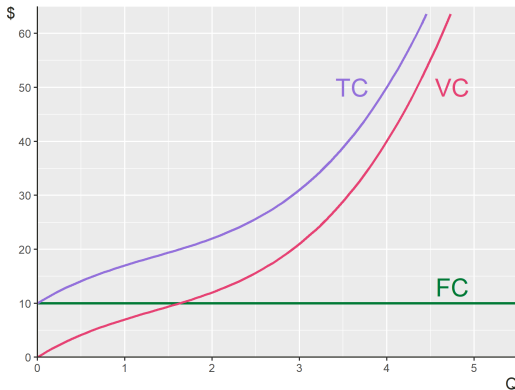○○○○○○○○○

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  • You will probably not have to factor a cubic
  • You may need to know the quadratic formula

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Typical TC, VC, and FC

TC and VC are based on cubic equations, for reference

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Typical AFC

▶ FC is constant, so AFC will look like $\frac{1}{x}$ (i.e. $\frac{1}{Q}$)

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Typical ATC and AVC

▶ Note that since $TC = FC + VC$, dividing the whole equation by Q implies

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$$ATC = AFC + AVC$$

▶ Therefore, the height difference between ATC and AVC is equal to AFC
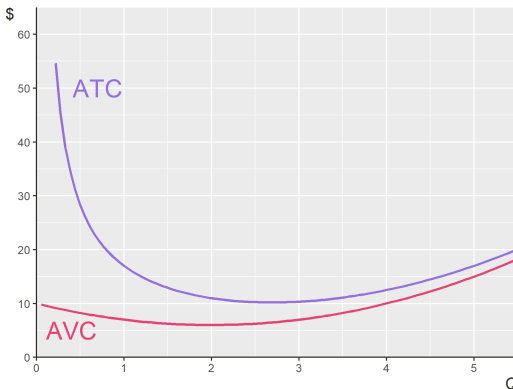
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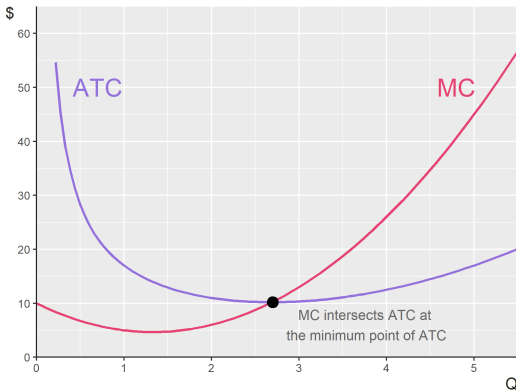
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Typical ATC and AVC (cont.)

▶ Note that when VC is near 0, ATC looks like AFC. As fixed costs get stretched over more production (so that AFC→ 0), our ATC tends towards and become AVC

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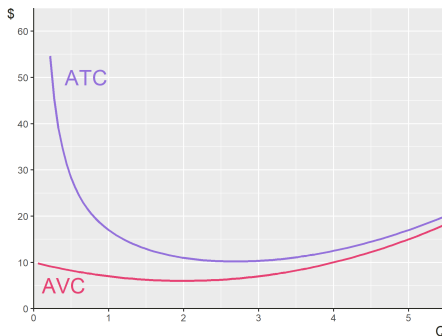
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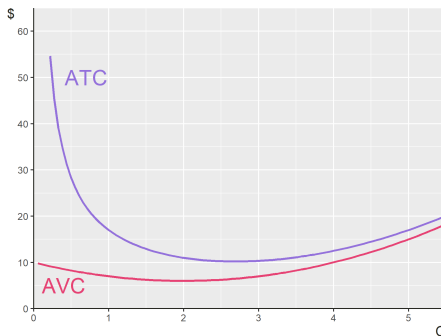
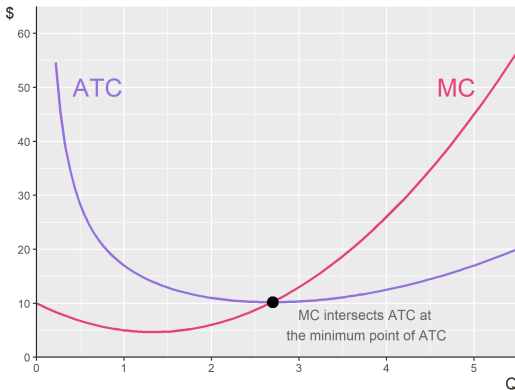▶ With that important part said, we may, for shorthand, just draw ATC as a parabola floating above AVC

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MC with ATC

▶ Finally, MC has a parabolic shape that often resembles a Nike swoosh

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MC with ATC

▶ Finally, MC has a parabolic shape that often resembles a Nike swoosh

▶ Note that the MC curve **always** intersects ATC at the minimum ATC (this will be very important later)

Some Notes about these Curves

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Costs – Types
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Short vs Long Run

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- In some contexts, for example, the distinction is with how sticky prices are: the short run is when prices do not move as much
- In this class, the distinction will mostly be defined by whether or not there are fixed costs

Defining the Notion of Long Run

▶ Recall that fixed costs can "sort of" depend on output: if the restaurant flips a million burgers, they have to replace their stove; if they flip 2 million, they will expand

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   • Put another way: *all inputs are variable in the long run*

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▶ Therefore, our rough definition for the **long run** will be that there are *no fixed costs*

  • Put another way: *all inputs are variable in the long run*
  • That is: factories can change their size, machines, and mode of production in the long run, but must keep some such factors fixed in the short run

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Deriving Long Run ATC

▶ A firm can choose from three factory sizes: small, medium, or large
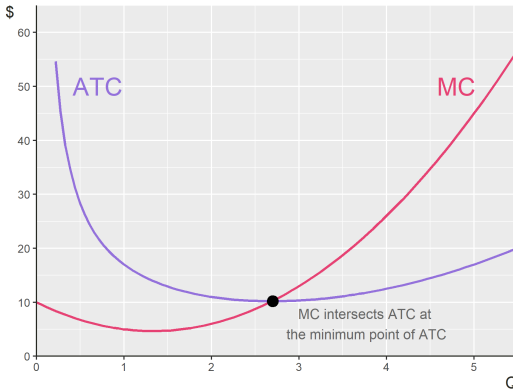
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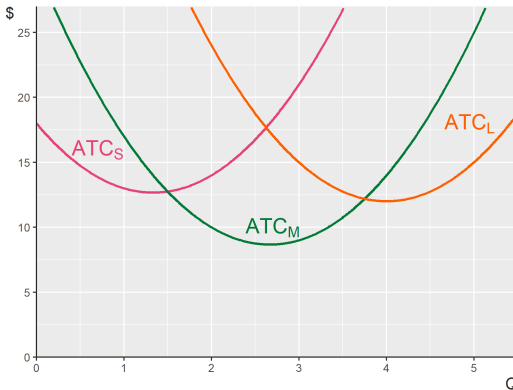
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Deriving Long Run ATC (cont.)

▶ The firm can change to a different factory size in the long run, but not in the short run

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Deriving Long Run ATC (cont.)

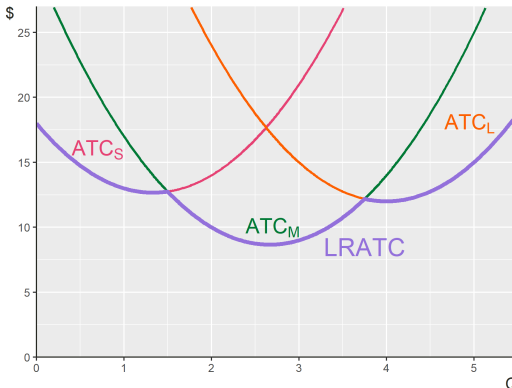▶ The firm can change to a different factory size in the long run, but not in the short run
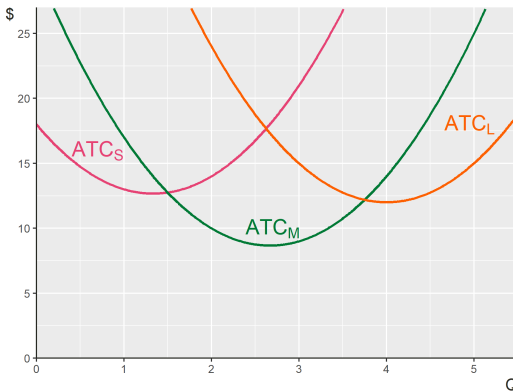

▶ What will the firm do in the long run?

Deriving Long Run ATC (cont.)

▶ In the long run, the firm will do whatever is the cheapest option, since they have full flexibility in their scale

Deriving Long Run ATC (cont.)

▶ In the long run, the firm will do whatever is the cheapest option, since they have full flexibility in their scale

▶ Hence, the Long Run Average Total Cost (LRATC) in this example is shown by

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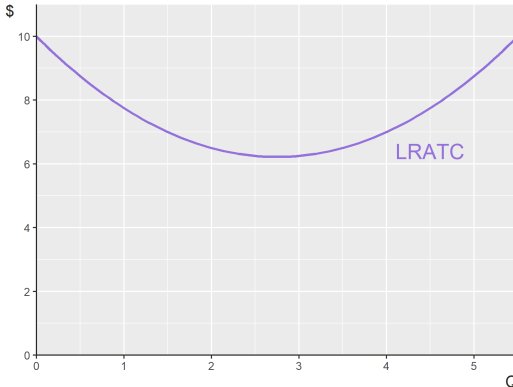00000000000000000000

Typical LRATC

▶ When considering a lot of different sizes over a lot of different production levels, we get a typical LRATC
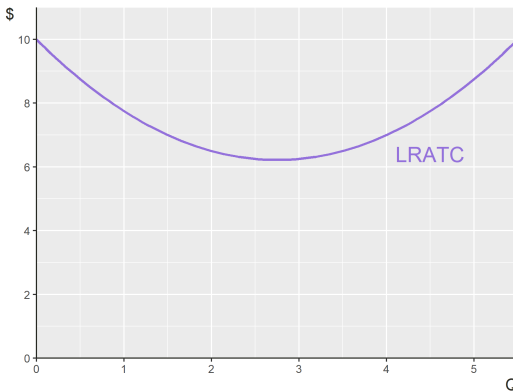
Typical LRATC

▶ When considering a lot of different sizes over a lot of different production
  levels, we get a typical LRATC

▶ There is often variation in how you can draw this, due to what we call
  returns to scale (RTS)

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Returns to Scale

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- That is: as we increase output (in the long run), are costs getting more expensive, less expensive, or about equal
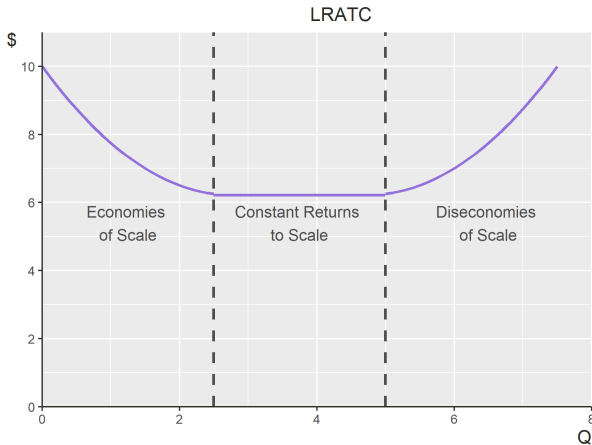
Returns to Scale

▶ Returns to scale measures the qualitative slope of LRATC, as output changes
  • That is: as we increase output (in the long run), are costs getting more expensive, less expensive, or about equal
  • Remember the relationship between a cost function and a production function: this is often a story of the state of the production function

Another Typical LRATC

Returns to Scale – Definitions

1. **Economies of Scale** (Positive RTS)

▶ We will return to the notion of short versus long run later, under the context of supply curves

Returns to Scale – Definitions

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   - Long-run ATC falls as the quantity of output rises

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1. **Economies of Scale** (Positive RTS)
   - Long-run ATC falls as the quantity of output rises
     - Characterized by increased specialization in workers
     - More common when Q is low

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2. **Constant Returns to Scale**

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   - Long-run ATC stays the same as the quantity of output rises
     - What you get in is what you get out

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     ◦ What you get in is what you get out
     ◦ Ex: restaurant chains

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   - Long-run ATC stays the same as the quantity of output rises
     - What you get in is what you get out
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3. **Diseconomies of Scale** (Negative RTS)

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Returns to Scale – Definitions

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Costs – Types
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Costs – Drawing
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Costs – Time Horizon
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Perfectly Competitive Markets
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Perfectly Competitive Markets
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     - Ex: McDonald's origin – as restaurants expand, you can't manage quality

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Types of Firms

▶ So far, we have only talked about the breakdown of costs that a firm faces, but not *why* we care about them and what we should do with them

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[2] Anything other than perfect competition is refereed to as *imperfect competition*

Types of Firms

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▶ In general, how a firm turns cost structure into supply decisions depends on the relative market power of a firm:

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- If costs go up for a firm like Comcast, they can likely pass those costs onto consumers, much easier than an Amazon seller

▶ In general, we break down the types of firms into the following picture[2]:

Many firms	Many firms	Few firms	One firm
Identical product	Similar but not identical products	Identical or similar products	No similar product
Perfect Competition	**Monopolistic Competition**	**Oligopoly**	**Monopoly**

---

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Ends of the Spectrum

▶ In this class, we will talk in detail only about the ends of this spectrum: perfect competition (PC) and pure monopoly

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▶ What is the most important decision that you think these firms make, once they have their costs, and know how much they are going to produce?

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▶ In terms of price, firms in perfect competition and monopoly are respectively refereed to as *price takers* and *price makers*

Key Descriptors to a PC Market

▶ The key descriptors of a perfectly competitive market are as follows:

With a third key descriptor, which we will often relax [3]

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Perfectly Competitive Markets
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EC 201

Connor Wiegand

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Perfectly Competitive Markets
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  • Amazon sellers: many vendors selling knock-offs of the same product for similar prices (this might be more of monopolistic competition, but again, our examples will be relaxed)
  • Agriculture: many farmers selling similar crops who have no individual say in the price of those crops (point 3 may not be satisfied here)

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Costs – Types
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Perfectly Competitive Markets
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Firms as Price Takers

▶ What do these firms have in common?

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Firms as Price Takers

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  • They have little individual say in what happens to the price of the good they are selling

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Firms as Price Takers

▶ What do these firms have in common?
  • They have little individual say in what happens to the price of the good they are selling
  • For instance, if a particular farmer or bracelet seller is hit with an individual hardship, if they raise the price, then the market drops out

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▶ What do you think happens if the firm tries to lower the price?

- They will gain the whole market, but their production will increase to a level such that they lose profit

---

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How Firms Choose Production Decisions

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▶ Recall the thinking for finding the optimal number of workers to hire:if it's profitable to keep going, keep going; if we are losing profit, go back; if we break even, we are at the sweet spot

▶ A firm trying to maximize profit will do the same thing: if it's worth it to sell another unit it, do it; if it's not, don't

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Costs – Types
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Costs – Drawing
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Costs – Time Horizon
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Perfectly Competitive Markets
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$$\boxed{MR = MC}$$

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▶ This is the general optimality condition for a firm choosing how much to produce

Costs – Types
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Perfectly Competitive Markets
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Optimally Producing Firm

▶ Given the following information, where does a firm produce at?

Output	TR	TC	π	MR	MC	$\Delta\pi$
0	0	20	-20	–	–	–
1	24	22				
2	48	28				
3	72	38				
4	96	52				
5	120	70				
6	144	92				
7	168	118				
8	192	148				

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▶ Note: filling out this table on your own is good practice, but we only need to fill out the MR and MC columns to answer this question!

Costs – Types
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Costs – Drawing
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Costs – Time Horizon
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Perfectly Competitive Markets
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Optimally Producing Firm

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Output	TR	TC	π	MR	MC	$\Delta\pi$
0	0	18	-18	–	–	–
1	24	22	2	24	4	20
2	48	30	18	24	8	16
3	72	42	30	24	12	12
4	96	48		24	16	
5	120	58		24	20	
6	144	82		24	24	
7	168	110		24	28	
8	192	142		24	32	

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5	120	58		24	20	
6	144	82		24	24	
7	168	110		24	28	
8	192	142		24	32	

▶ Particularly, if you fill out $\Delta\pi$, what do you see as we approach and go through $Q = 6$?

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Costs – Types
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Perfectly Competitive Markets
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Marginal Revenue

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Perfectly Competitive Markets
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Costs – Types
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$$\boxed{MR = P}$$

▶ That is, marginal revenue is constant and equal to price

▶ Note: when a larger firm has influence over it's price, selling another unit might mean changing the price you are selling all units at, so this result is unique to PC markets

How Firms Choose Production Decisions

▶ Combing the general optimality rule for how much a firm should produce, $MR = MC$, with the PC firm's marginal revenue that was just derived, we get the following formula for where a PC firm should produce:

$$\boxed{P = MC}$$

How Firms Choose Production Decisions

▶ Combing the general optimality rule for how much a firm should produce, $MR = MC$, with the PC firm's marginal revenue that was just derived, we get the following formula for where a PC firm should produce:

$$P = MC$$

▶ Verbally, a firm should produce such that marginal cost is equal to the price

Costs – Types
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Perfectly Competitive Markets
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Optimally Producing PC Firm

▶ Given the following information, where does a PC firm produce at?

Output	P	TR	TC	π	MR	MC	$\Delta\pi$
0	6		8		–	–	–
1	6		9				
2	6		12				
3	6		17				
4	6		24				
5	6		33				
6	6		44				
7	6		57				
8	6		72				

Optimally Producing PC Firm

▶ Note: filling out this table on your own is good practice, but we only need to fill out the MC column to answer this question!

Output	P	TR	TC	π	MR	MC	$\Delta\pi$
0	9		8		–	–	–
1	9		9			1	
2	9		12			3	
3	9		17			5	
4	9		24			7	
5	9		33			9	
6	9		44			11	
7	9		57			13	
8	9		72			15	

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[6]A: $12

Costs – Types
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Perfectly Competitive Markets
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Output	P	TR	TC	π	MR	MC	$\Delta\pi$
0	9		8		–	–	–
1	9		9			1	
2	9		12			3	
3	9		17			5	
4	9		24			7	
5	9		33			9	
6	9		44			11	
7	9		57			13	
8	9		72			15	

▶ Bonus Question: How much profit does the firm make at this point?

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[6]A: $12

Costs – Types
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Perfectly Competitive Markets
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Optimally Producing PC Firm

▶ Note: filling out this table on your own is good practice, but we only need to fill out the MC column to answer this question!

Output	P	TR	TC	π	MR	MC	$\Delta\pi$
0	9		8		–	–	–
1	9		9			1	
2	9		12			3	
3	9		17			5	
4	9		24			7	
5	9		33			9	
6	9		44			11	
7	9		57			13	
8	9		72			15	

▶ Bonus Question: How much profit does the firm make at this point?

---

[6]A: $12

Optimally Producing PC Firm

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[6] A: $12

Costs – Types
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Costs – Drawing
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Costs – Time Horizon
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Perfectly Competitive Markets
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Another Way to Write Profit

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

Costs – Types
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Perfectly Competitive Markets
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Perfectly Competitive Markets
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Costs – Types
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Perfectly Competitive Markets
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Another Way to Write Profit

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

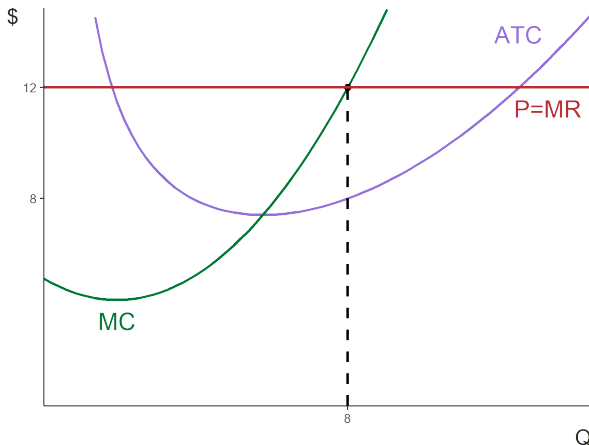▶ Since $TR = P \cdot Q$, we can write this as

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

Costs – Types
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Costs – Drawing
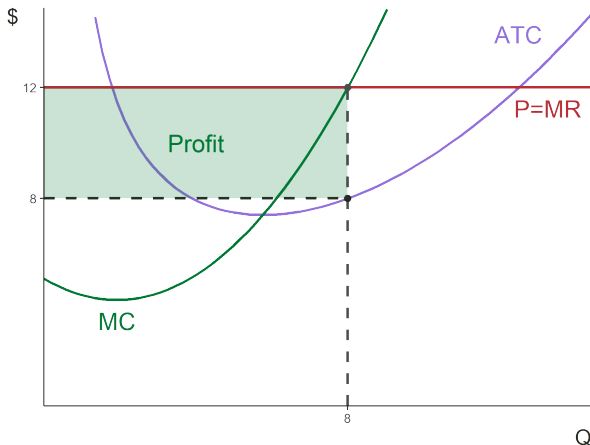○○○○○○○

Costs – Time Horizon
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Perfectly Competitive Markets
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Visualizing Profit for a PC Firm

▶ Recall our example picture, now with price added:

Note that the firm is choosing to produce where P=MC

Costs – Types
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Costs – Drawing
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Costs – Time Horizon
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Perfectly Competitive Markets
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Visualizing Positive Profit for a PC Firm

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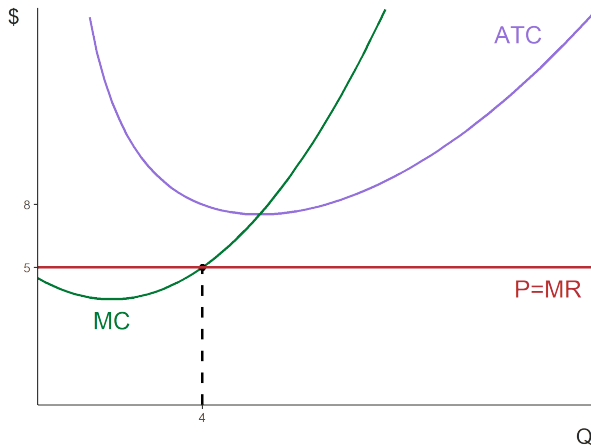

In this case, $\pi = 8\,(12 - 8) = \$32$

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Costs – Drawing
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Costs – Time Horizon
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Perfectly Competitive Markets
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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:
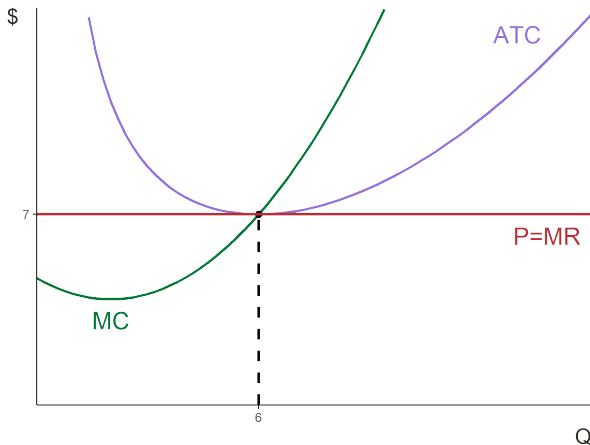
Costs – Types
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Costs – Time Horizon
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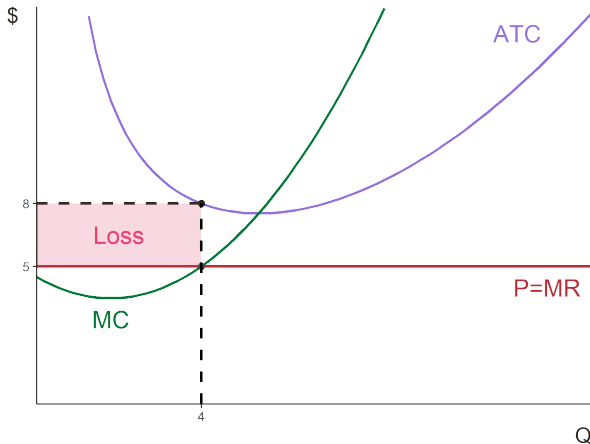Perfectly Competitive Markets
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Visualizing Negative Profit for a PC Firm

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

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Costs – Time Horizon
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Perfectly Competitive Markets
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Visualizing Negative Profit for a PC Firm

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

How the Book Derives Optimal Profit for the Firm

▶ The book carries this discussion a little differently than I have

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[7] I don't know if we will find use for this

Costs – Types
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Perfectly Competitive Markets
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- One result that the book points out[7] is that if we were to define
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$$AR = \frac{PQ}{Q} = P$$

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- Therefore, for *any* firm, AR is equal to the price

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EC 201

Connor Wiegand

Costs – Types
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Costs – Drawing
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Perfectly Competitive Markets
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- Therefore, for *any* firm, AR is equal to the price

▶ They motivate the profit maximization of the firm using more table-thinking. I expect you to read this on your own (mainly 14-1b thru 14-2b, but all of chapter 14)

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