

Lecture 9(iii) **Announcements**

You should start “Supply” Worksheet at week 10 of Canvas.

Midterm Mon Nov 12, 7pm-8pm

If conflict, register by Mon, (Nov 5), 4pm to avoid **late registration penalty**. Email head grader, headgrader@gmail.com

- **Question and Answer Sessions**
- Wed Nov 7: 4-5:30: Anderson **310**
- Wed Nov 7, 7:30-9: Anderson **210**
- Thur Nov 8 3:30-5 : Anderson **210**

Don't forget to vote for the carbon policy platforms at Canvas week 10 to get bonus points.

Lecture

1. Review: Short-run Supply of **Firm**
2. Long-run Supply of **Firm**
3. Long-run Supply of Competitive Industry
4. Short-run Supply of Competitive Industry

Supply of Competitive Firm Takes P as given

Supply of S1?

Easy. $P > 1$ then $Q = 1$

$P < 1$ then $Q = 0$

Supply of S11?

Harder

Suppose $P = \$7$. What to do?

Start by making a table

Profit = Revenues minus Total Cost

Pick Q to maximize profit

Q	R $P \times Q$	Total Cost	Profit R-TC	MC	MR
0	0	4	-4		7
1	7	6	1	3	7
2	14	10	4	5	7
3	21	16	5	7	7
4	28	24	4	9	7

Profit maximizing quantity = 3

Shortcut to figuring this out (so don't need to make a table)

Look at **Marginal Revenue** (change in revenue from producing one more. For competitive firm, $MR=P$. Compare with **Marginal Cost (MC)**)

If $MR > MC$ produce more to raise profit

If $MR < MC$ produce less

If $MR = MC$? Just right.

Rule for profit maximizing output for a competitive firm:

If produce, set Q where
Marginal Revenue = Marginal Cost
But check whether worth being open at all. When do this make a distinction between **short run** and **long run**.

Short Run: fixed cost can't be avoided. Have to pay the rent.
(For S11, $FC = 4$)

S11 can avoid hiring labor, and also buying materials.

When pick output, forget (in short run) about the rent.

Produce as long as $P \geq AVC$

Long Run Can exit the industry (not renew lease.) Produce as long as

$$P \geq ATC$$

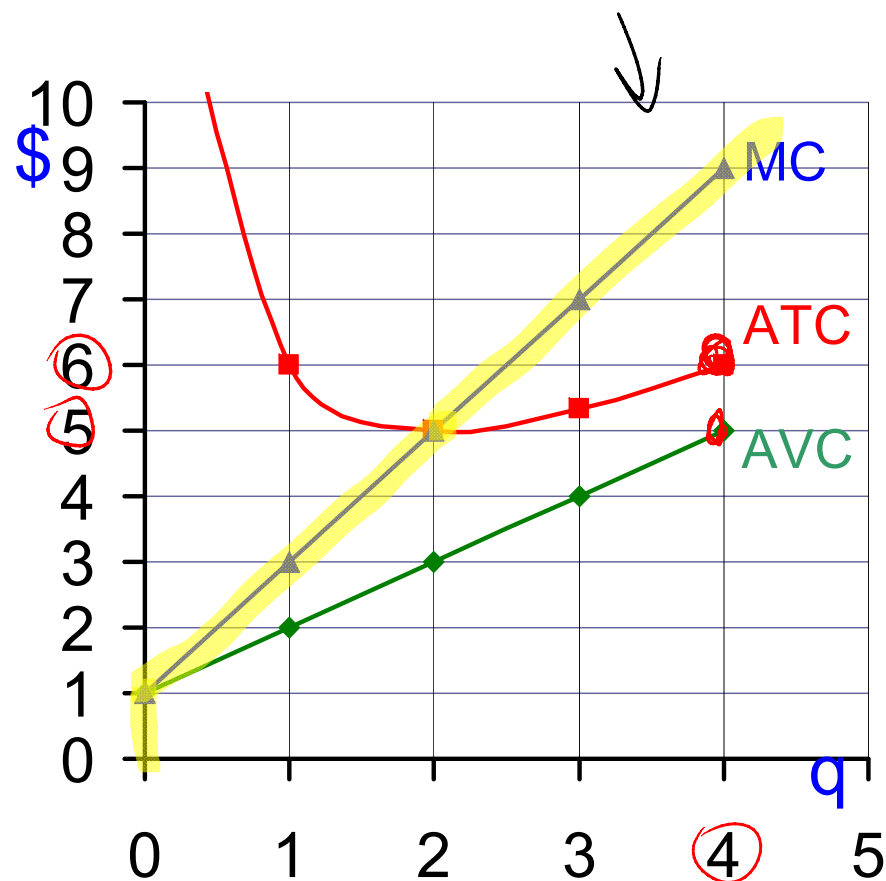
Short-Run Supply of Competitive Firm

Rule:

- Find quantity such that $P = MC$
- Check that $P \geq AVC$ at that quantity, produce there.
- Otherwise: Shut down.

Helpful Tip: You can figure out what Fixed Cost is from the graph on the right, even though it doesn't show AFC directly. Here is how. Pick any quantity, let's go with $q=4$. At $q=4$, we can see that $ATC=6$ and $AVC=5$. We know that AFC must be the difference between ATC and AVC, so AFC must equal 1 ($=6$ minus 5) at $q=4$. Since $AFC=FC/q$, the fixed cost must equal $FC=4$.

Short Run Supply Curve For S11



What happens when $P = 3$?

$$P = MC \text{ at } \underline{Q = 1}$$

$$AVC = 2 \text{ at } Q = 1, \text{ so } \underline{P} > \underline{AVC}$$

$$\begin{aligned} \text{Profit} &= R - TC \\ &= P \times Q - FC - VC \\ &= 3 \times 1 - 4 - 2 = -3 \end{aligned}$$

Not happy about losing 3 dollars, but it is better than shutting down and losing 4 dollars (since rent is fixed)

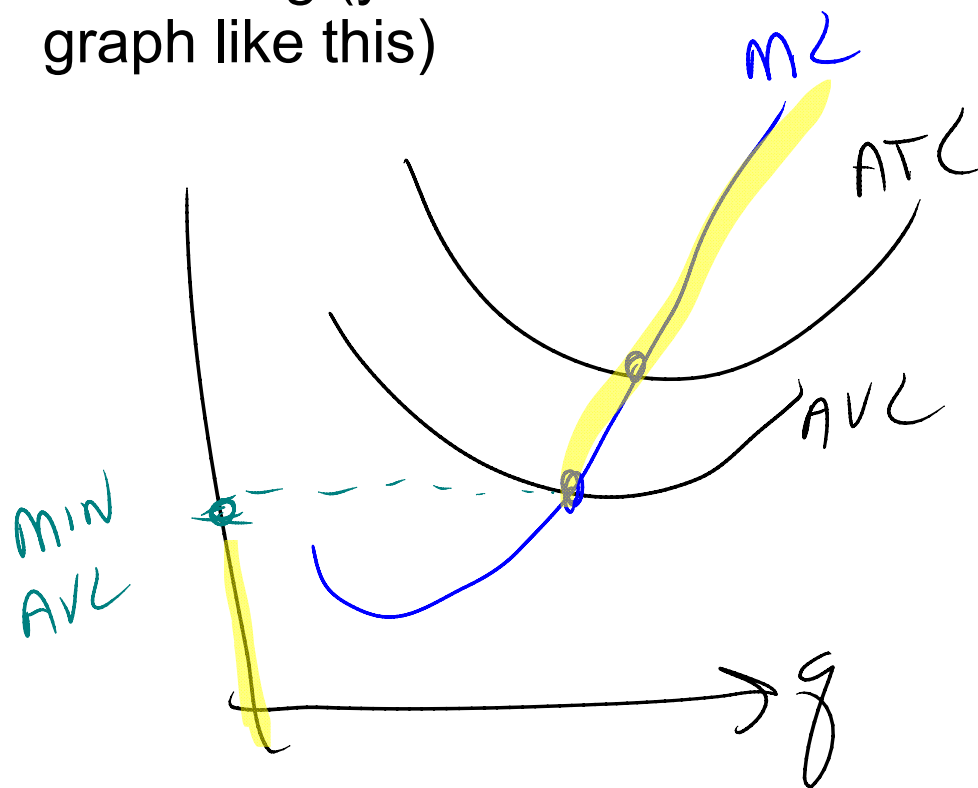
Compare with loss at $Q = 0$.

$$Q = 0 \\ \text{Profit} = 0 - 4 = -4$$

What happens at $P = .5$?

$Q = 0$ is optimum.

Here is a different example where AVC is first decreasing then increasing (your textbook has a graph like this)



Long Run Supply of Firm

Supply when rent on factory is variable input

In long run all costs are variable, so $AVC=ATC$. If price less min ATC then shut down



Long Run Supply of Industry With Free Entry

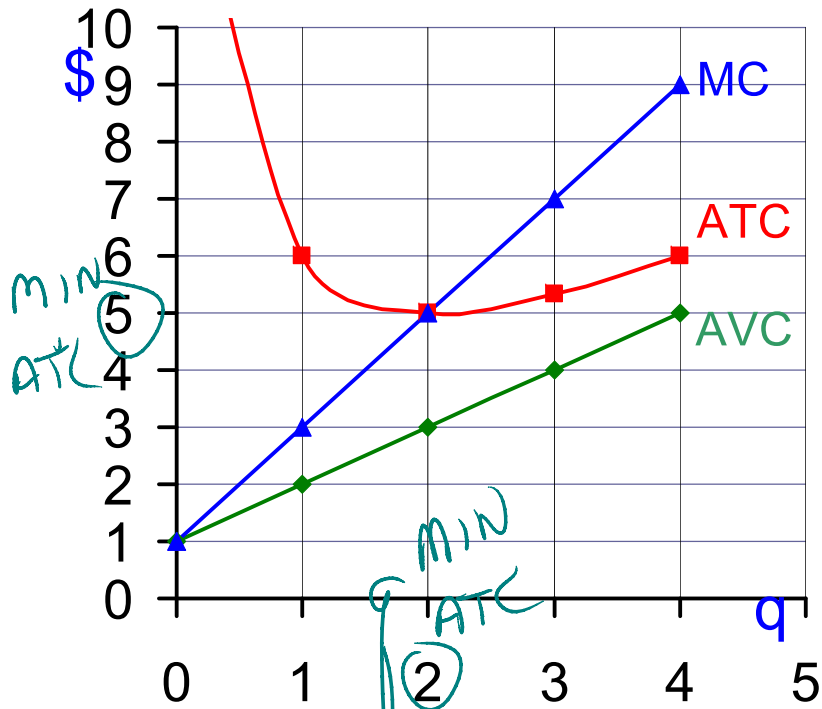
Suppose:

- Same Technology is available for all
- No barriers to entry
- Input prices to industry do not go up as the industry expands

Then in long-run equilibrium:

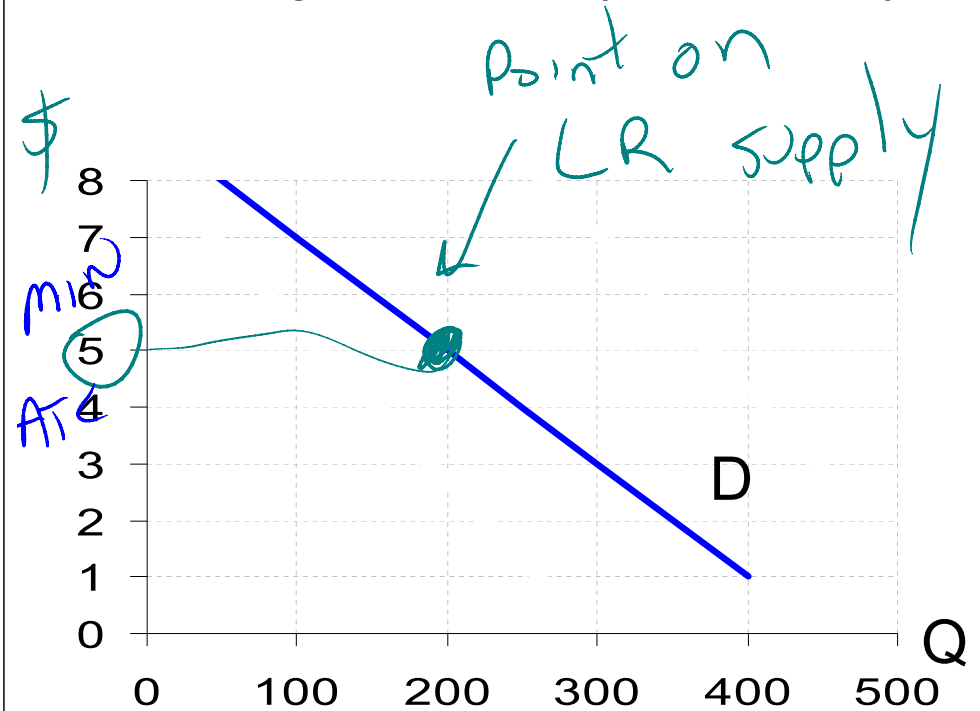
- Price equals $P^* = \text{MinATC}$
- Each firm produces quantity q^* where ATC is minimized $q^{\text{min ATC}}$
- Number of firms N^* is Demand at P^* divided by q^* .

Again: S11 Cost Structure



Variable	Definition
P^{LR}	long-run price
Q^{LR}	long-run quantity
q^{LR}	output per firm
N^{LR}	number of firms

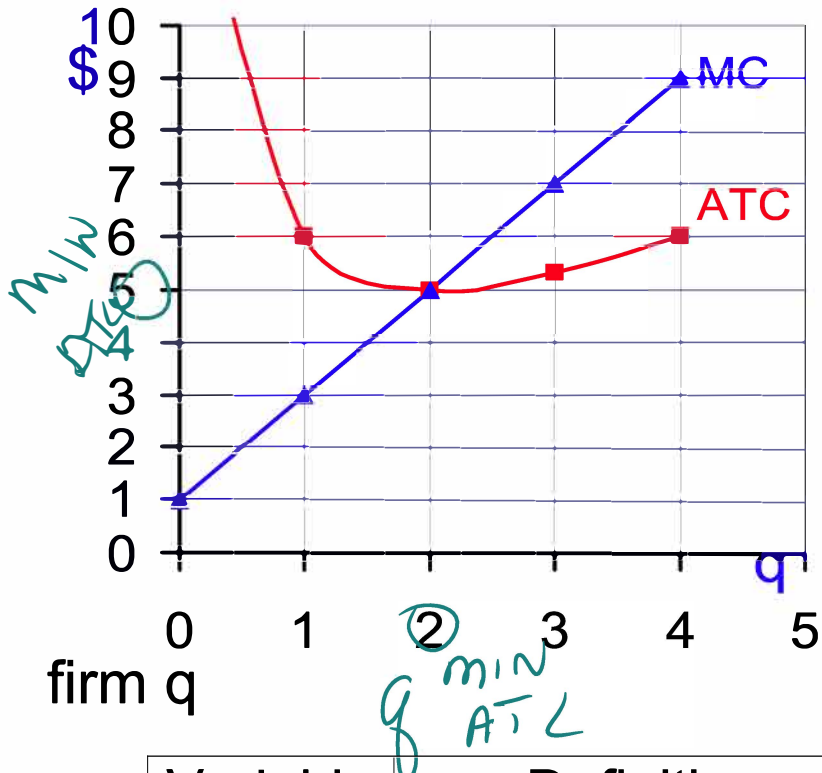
Long Run Supply of Industry



1. Price in LR equals MIN ATC = 5.
2. Look to demand curve to figure out industry quantity Q . Demand is 200 at $p=5$, so $Q=200$.
3. Output per firm is $q=2$. This is the profit-maximizing quantity where $p = MC$. Note at $q = 2$, $P = MC = ATC = 5$.
4. Number of firms equals $200/2 = Q/q=100$
With 100 firms, each producing 2 we get 200.

2

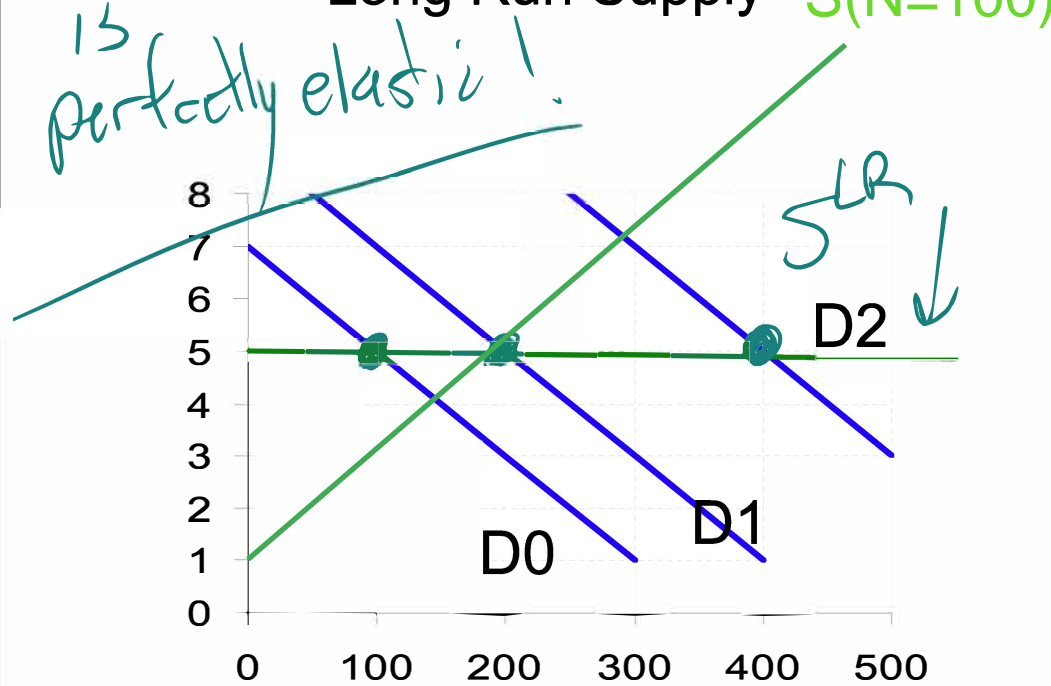
Again: S11 Cost Structure (FC = \$4)



firm q

Variable	Definition
P^{LR}	long-run price
Q^{LR}	long-run quantity
q^{LR}	output per firm
N^{LR}	number of firms

Long Run Supply $S(N=100)$



	Demand		
	D0	D1	D2
P^{LR}	5	5	5
Q^{LR}	100	200	400
q^{LR}	2	2	2
N^{LR}	50	100	200

min ATC
Demand
min ATC
 $= \frac{Q}{q}$

First Welfare Theorem at Work Here

In long-run competitive equilibrium, Q^{LR} is produced at in the minimum cost way (Efficient Production)

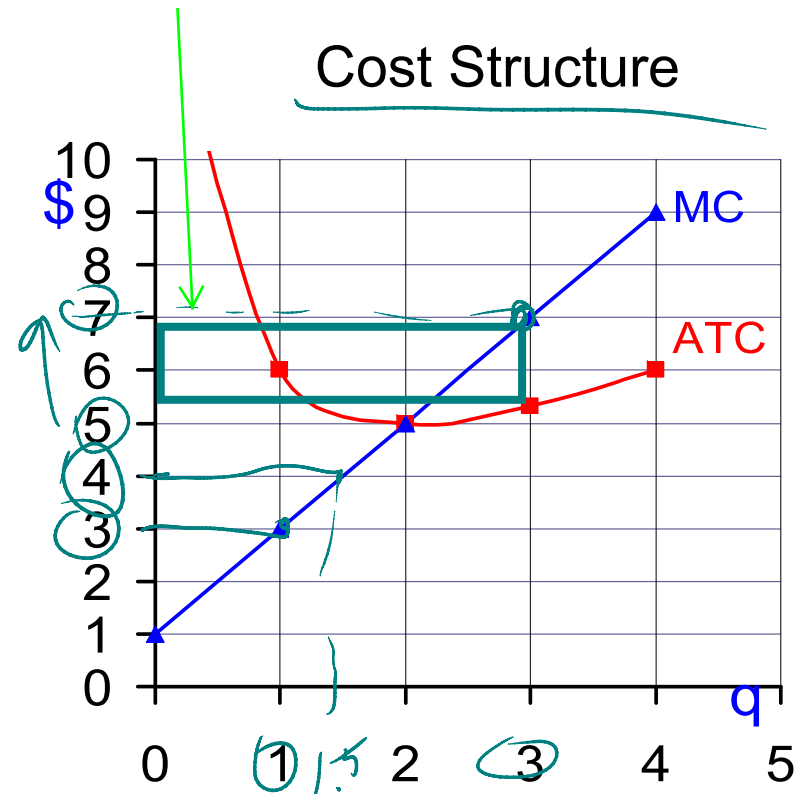
Short Run

Number of firms is fixed.

Suppose in long-run equilibrium at when demand is D1 (so $N = 100$)

What is Short-Run Supply Curve?

Profit in short run when $P = 7$



Price	Firm SR supply	Industry SR supply (N=100)
✓ 3	✓ 1	100
✓ 4	1.5	150
✗ 5	2	200
✓ 7	3	300