Theory of the Firms: Supply
Econ 1101

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ECON 1101 Lecture 9.3

1. Short Run Supply curve of firm

2. Long Run Supply curve of firm

3. Long Run supply of competitive industry

4. Short Run Supply of competitive industry

ECON 1101 Lecture 9.3

1. Short Run Supply curve of FIRM

Introduction

- In EconLand S1 - S10 had very easy decisions: produce or don't produce, but can only produce one unit

- With S11, S12 and S13 its not that simple since they have varying costs, can produce more than unit, etc

- We now need to assume how firms act, and we assume they are **profit maximizers**

- Profit maximization - firms will produce a quantity such that their profits (= Revenue - Total Cost) are as high as possible given a price

- Given a price: because we are in competitive markets (where firms are price takers)

Short Run Supply of Firms

To figure out supply of firm (S11) we need to find the quantity that maximizes profit

- Suppose price = 7
- Profit = Revenue - TC   (where revenue is P*Q)
- From previous analysis we know TC, lets derive Rev, profit and MR

Q	Revenue= P×Q	Total Cost	Profit= Revenue-TC	MC (Marginal Cost)	MR (Marginal Revenue)
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

Short Run Supply of Firms

Q	Revenue= P×Q	Total Cost	Profit= Revenue-TC	MC (Marginal Cost)	MR (Marginal Revenue)
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Profit maximizing quantity = 3

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

Look at <u>Marginal Revenue</u> (change in revenue from producing one more. For competitive firm, MR=P.

Compare with <u>Marginal Cost</u> (MC)

So the quantity at which MC=MR is optimal!

Optimal quantity

- So the quantity at which MC=MR is optimal!

- The quantity at which MC=MR is the profit maximizing quantity.

- Why? What is the intuition? What if:
  - MC>MR?
  - MC<MR?

Optimal quantity

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

Supply firm: Short Run and Long Run

In the <u>short run</u>:

- Fixed cost can't be avoided... have to pay the rent. (For S11, FC = 4)
- However, S11 can avoid hiring labor, and also avoid buying materials
- When S11 picks output, forget (in short run) about the rent, since that can't be avoided in the short run.
- Produce as long as P ≥ AVC (When price is higher than average variable cost, what does that mean intuitively?)

In the <u>long run</u>:

- Can exit the industry (not renew lease), so fixed cost can be avoided
- Produce as long as P ≥ ATC (Since fixed cost can be avoided, we now compare with average TOTAL cost instead of just average VARIABLE cost)

Short Run Supply: Rule

Rule:

- Find quantity such that P = MC
- Check that P ≥ AVC at that quantity and produce there.
- Otherwise: Shut down.

Short Run Supply Curve

FC = 4 (rent)
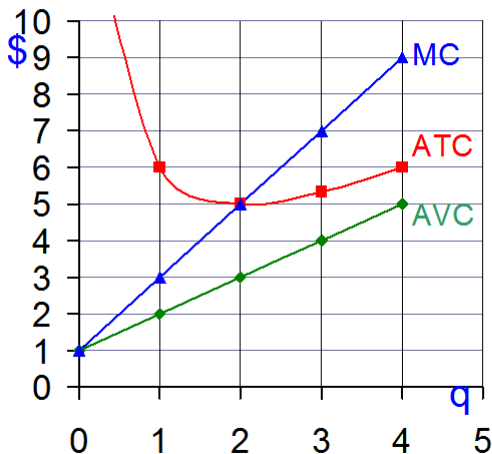
To figure out the supply curve:

What happens when P = 3?

P = MC at Q = 1 (Remember that for a competitive firm, P=MR, so here, MR=P=MC)

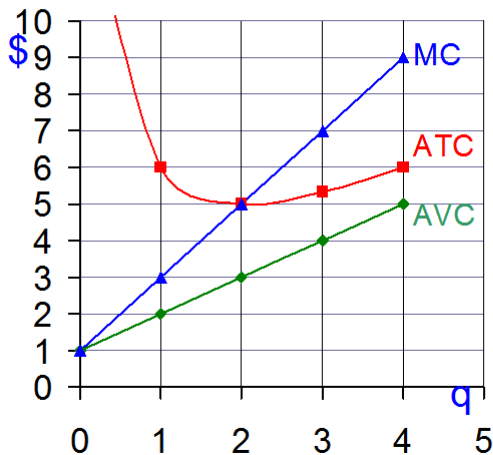AVC = 2 at Q = 1, so P > AVC

Profit = R − TC
= P×Q − FC − VC
= 3×1 - 4 - 2 = **-3**

Wait, what?! Negative profit? Would they want to produce in the short run with negative profit?

Short Run Supply Curve

FC = 4 (rent)

What happens at P=$1?
- MR=MC=1 Q*=1/2
- With AVC =1/2<P produce

At P=$0.5?
- MR=MC=0.5 Q=1/4
- With AVC = ¼<P
- produce

Short Run Supply Curve

FC = 4 (rent)
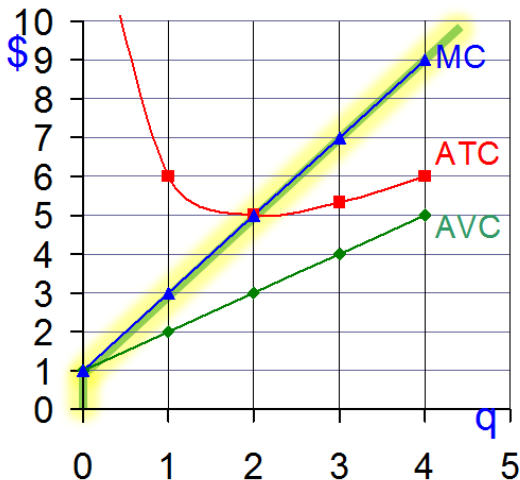
So putting the two together, we get our short run supply curve (in green/glowing yellow)
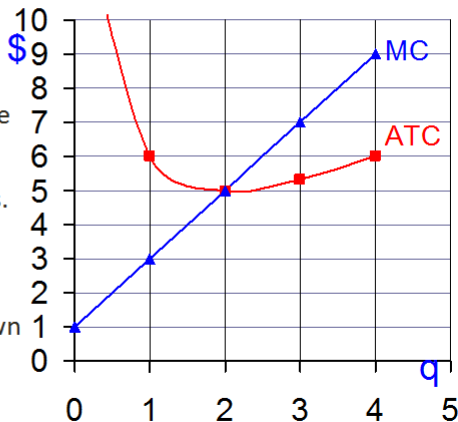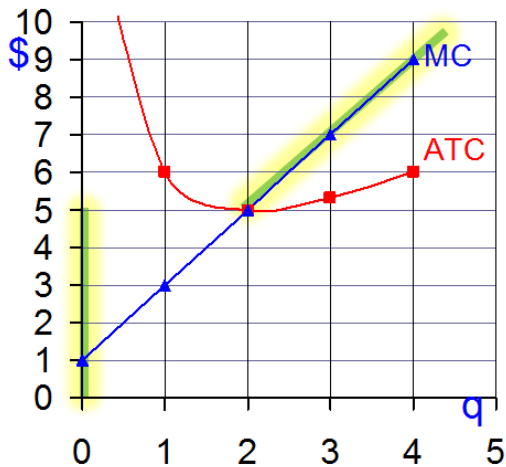
Long Run Supply: Rule

Rule:

- Find quantity such that P = MC
- Check that P ≥ ATC at that quantity and produce there.
- Otherwise: Shut down.

Long Run Supply

In long-run, there are no fixed costs, just variable costs (now, even rent is a variable cost since firms can decide to renew or not renew a lease)

Note that there is only ATC now (ATC=AVC), all the costs a firm faces in the long run are variable costs.

Supply is quantity where P>ATC, otherwise shutdown and produce 0.

Long Run Supply

Long Run Supply of Industry (competitive - 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* = MinATC
- Each firm produces quantity q* where ATC is minimized
- Number of firms N* is Demand at P* divided by q*.

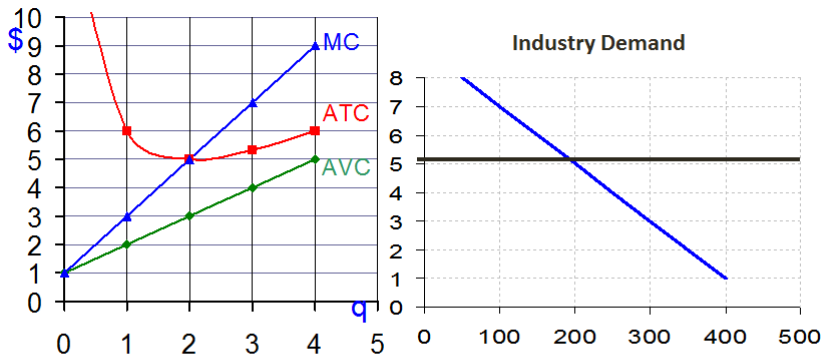In the long run equilibrium, competitive firms make **zero economic profit**

Long Run Supply of Industry (equilibrium)

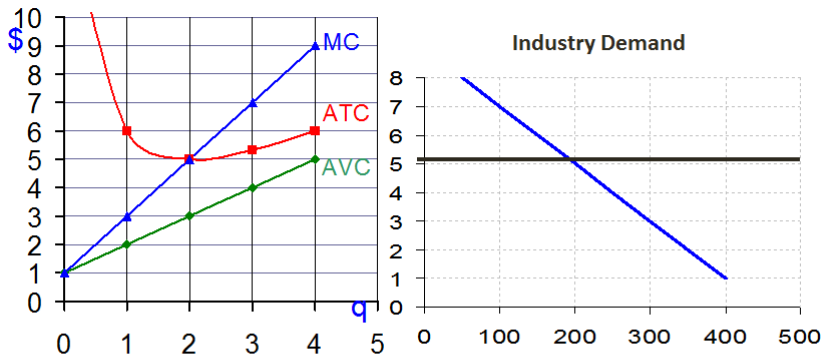| Variable	Definition
P^{LR}	long-run price
Q^{LR}	long-run quantity
q^{LR}	output per firm
N^{LR}	number of firms

1. P^{LR} =min ATC =
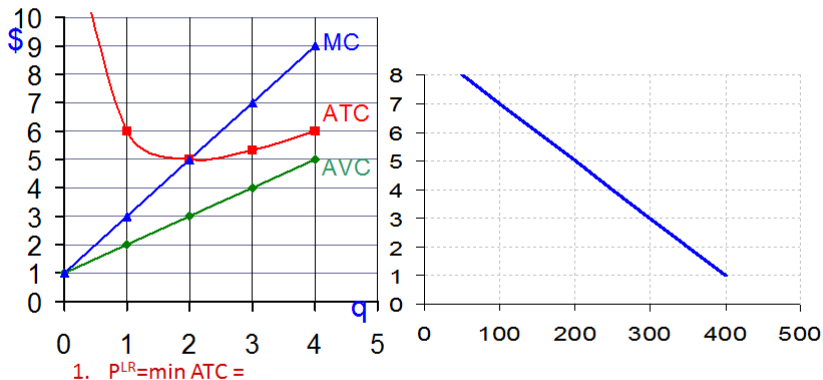
Long Run Supply of Industry

1. P^{LR}=min ATC = $5
2. q^{LR}=q*=

Small "q" denotes a single firm's production, big Q is quantity of the industry
How did we find q*?

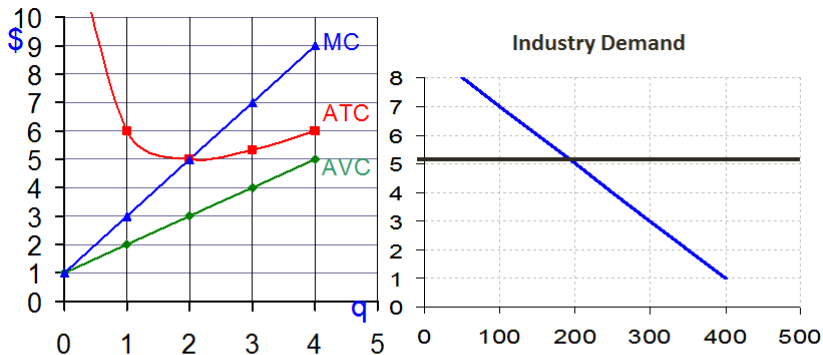# Long Run Supply of Industry

1. P^{LR}=min ATC = \$5
2. q^{LR}=q*= 2
3. Q^{LR}=

First, what must the price of the good be in the long run? Then, what quantity does that correspond to on the industry demand curve?

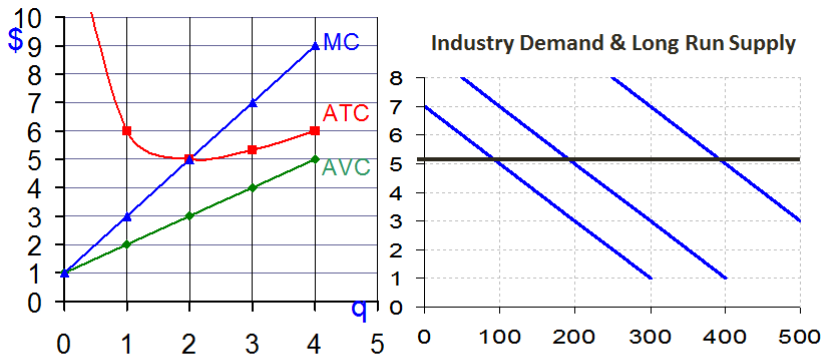# LR Supply of Industry... Deriving the equil

1. P^{LR}=min ATC = $5
2. q^{LR}=q^*= 2
3. Q^{LR}= 200
4. N^{LR}= 100

If there total quantity, Q=200, and each firm produces.... 100

LR Supply of Industry... Change in Demand

Industry Demand & Long Run Supply

	Demand		
	D1	D2	D3
p^{LR}			
Q^{LR}			
q^{LR}			
N^{LR}			

LR Supply of Industry... Change in Demand

	Demand		
	D1	D2	D3
P^{LR}	5	5	5
Q^{LR}	100	200	400
q^{LR}	2	2	2
N^{LR}	**50**	**100**	200

- With different demand curves, we see that it does not affect how much each individual firm will produce. They will still produce 2.

- What does change is the number of firms. Because P= min ATC in the long run equilibrium (remember, if P > min ATC, then that means firms are making profits and more firms will enter, driving the price down. Eventually we hit P=min ATC.)

- First Welfare Theorem at work here
  - In long-run competitive equilibrium, Q^{LR} is produced in the minimum cost way (efficient production)
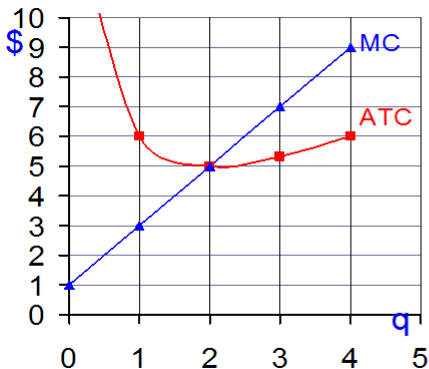
SR Supply of Industry

Short Run

- **<u>Number of firms is fixed.</u>**

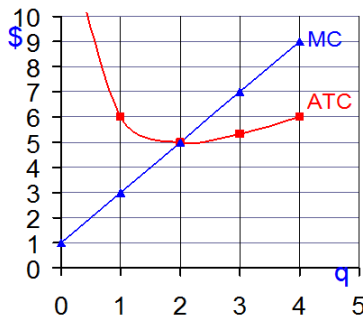Suppose we start in long-run equilibrium where demand is D1 (so N = 100)
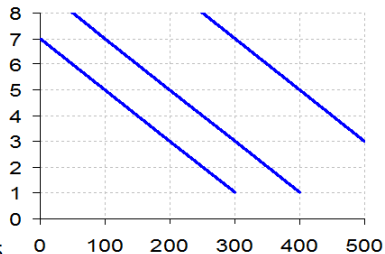
- What is Short-Run Supply Curve?

SR Supply of Industry

Price	Firm SR supply	Industry SR supply (N=100)
3	1	
4	1.5	
5	2	
7	3	

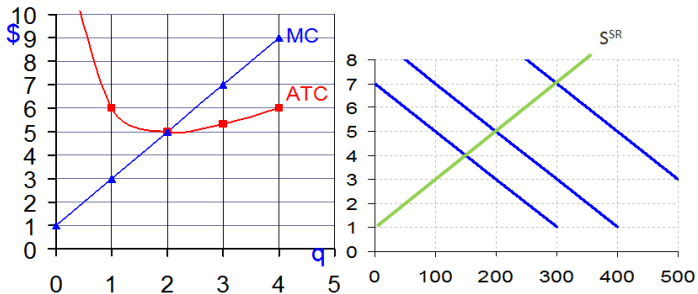# SR Supply of Industry

Suppose we are at D1 to start with

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

How do we find short run industry supply curve?

Do we have all the information we need?

How much do each firm produce at each price?
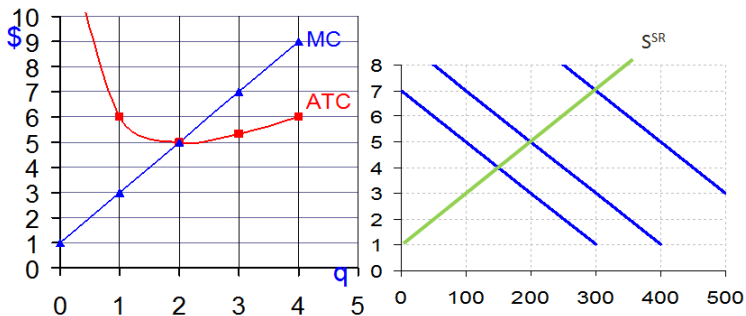
SR Supply of Industry

Suppose start at D1 in long-run eq. Suppose
we shift to D2. In short run:

$P \rightarrow$ __7___

$q \rightarrow$ __3___

firm profit = [P − ATC]q

$\quad\quad$ =[7 − 5.33]*3 = 5

SR Supply of Industry

In the LR, firms enter the market since an individual firm is making profits. As more firms enter, the amount of profit an individual firm makes falls until it hits 0. This is when P=$5. We are now at a long run equilibrium of $5 and Q=400. (Where LR Supply intersects D2)

SR Supply of Industry
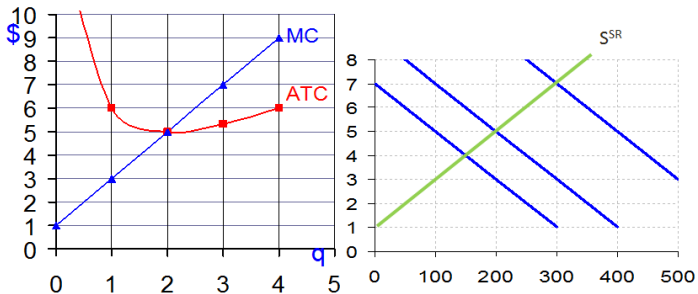
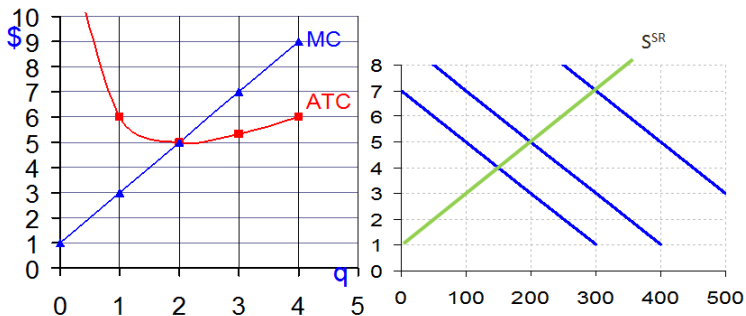Suppose start at D1 in long-run eq. Suppose
we shift to D3. In short run:

P→ __4___

q→ __1.5___

firm profit = [P − ATC]q

=[4 − 5.17]*1.5 = -1.75

SR Supply of Industry

In the LR, firms exit since an individual firm is losing money. As more firms exit, the amount of profit an individual firm makes goes up until it hits 0. This is when P=$5. We are now at a long run equilibrium of $5 and Q=100. (Where LR Supply intersects D3)