Supply

Moving documents across the country

Method	Cost		Rate
USPS	$0.32	1 week	1 doc/week
USPS - Express	$3.00	3.5 days	2 doc/week
Fed Ex	$10.00	2 days	3.5 doc/week
Fed Ex Overnight	$18.00	1 day	7 doc/week
Private Jet	$8000	6 hours	28 doc/week

For now, it looks like as we increase the rate of production, the (marginal) cost of production increases. Not my favorite example, but it will give you some flavor of the principle of increasing marginal cost.

How do I derive a supply curve?

Suppose, somehow, we know what the total costs of production are for all the various units of output. Maybe we hire some engineers and they tell us. If we produce one unit of output it will cost $1. If we produce two units of output, it will cost $4... From this information, we can calculate marginal costs

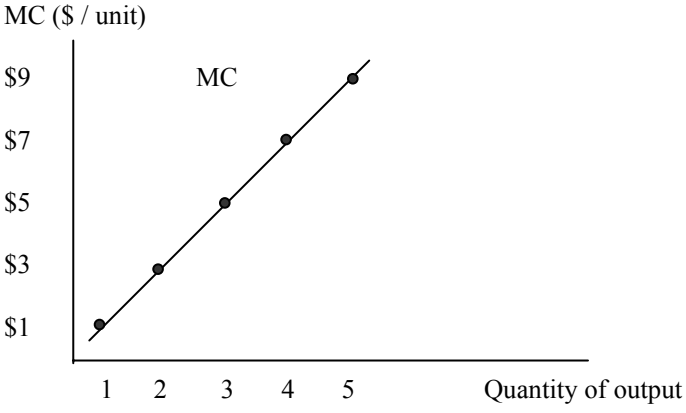
Units of Output	Total Costs (TC)	Marginal Cost (MC)
0	$0	----
1	$1	$1
2	$4	$3
3	$9	$5
4	$16	$7
5	$25	$9

We go about calculating **marginal cost (MC)** the same way we calculated marginal value. Marginal cost is defined as the change in total cost associated with producing one additional unit of output.

For example, if the total cost of producing 3 units of output is $9 and the total cost of producing 4 units is $16, what is the MC of producing the 4^{th} unit of output? It is the additional cost associated with producing the 4^{th} unit, so $16 - $9 or $7.

The principle of rising marginal cost - the higher the rate of production, the higher the marginal cost of producing an addition unit of output. Notice how this looked in the document example.

Below, for kicks, I have plotted the values of MC for the various levels of output



Assert a decision rule - firms choose to produce at a rate such that marginal cost is equal to the market price of the good.

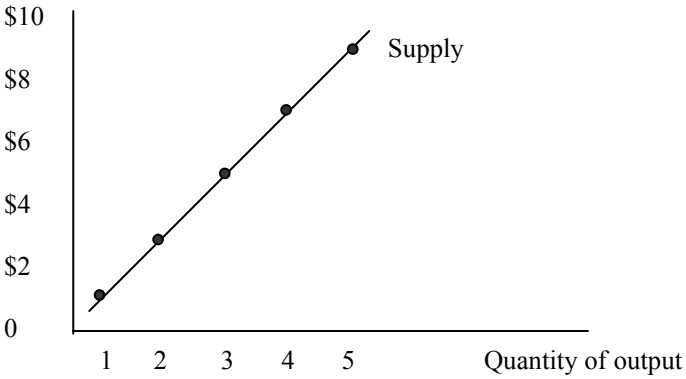
Suppose P = $7. Firms choose to produce where MC = P (= $7). This occurs at 4 units of output. Thus, for P = $7, Q = 4.

Suppose P = $5. Firms again choose to producer where MC = P (=$5). This occurs at 3 units of output. Thus, for P = $5, Q = 3.

Repeat...if P = $3, Q = 2. If P = $1, Q =1.

Thus, we have the relationship between price and quantity supplied that we are looking for (a supply curve).

Suppose I were to now plot these price and quantity combinations. I have plotted them below. Does the picture look familiar? It should, it is simply the MC curve re-labeled (see previous page).



A supply curve is the same thing as a marginal cost curve. Just like a marginal value curve turned out to be a demand curve, the marginal cost curve turns out to be a supply curve.

The supply curve shows us the relationship between price and quantity supplied. It shows us how much of the good suppliers will produce for each level of price.

Does our decision rule make sense?

We assume that the firm strives to maximize profits. Thus our decision rule would make sense, if, by picking the output where P = MC, firms also maximized profit. This is true. To see this, do a few calculations, and fill in the last two columns of the chart. At first, we'll assume that the market price is $7.

Units of Output	Total Costs	Marginal Cost	Total Revenue	Profit
0	$0	----	$0	$0
1	$1	$1	$7	$6
2	$4	$3	$14	$10
3	$9	$5	$21	$12
4	$16	$7	$28	$12
5	$25	$9	$35	$10

Total Revenue = Price * Quantity (Price is assumed to be $7).

Profit = Total Revenue - Total Costs

Our decision rule says that firms will select an output where MC is just equal to P. Price is \$7, and we found above that MC = \$7 at an output of 4. The decision rule results in 4 units of output being produced. Notice, this results in \$12 of profit, the best the firm can do. The decision rule has maximized profits.

Even better, let's look at it one unit of output at a time. Recollect that MC is the additional cost associated with producing one extra unit.

> The first unit costs only \$1 to produce (MC = \$1), but it can be sold at a price of \$7. The profit on this unit would be \$6. It should be produced.
>
> The second unit has a MC of \$3, but can be sold for \$7. The profit on this unit would be \$4. Produce it.
>
> The third unit has a MC of \$5, P = \$7, profit = \$2, so produce it.
>
> The fourth unit has a MC of \$7, P =\$7, profit = \$0, you're indifferent, but ah heck, produce it.
>
> The fifth unit has a MC of \$9, P = \$7, so'd you be losing \$2 on this unit. Don't produce. You've gone to far.

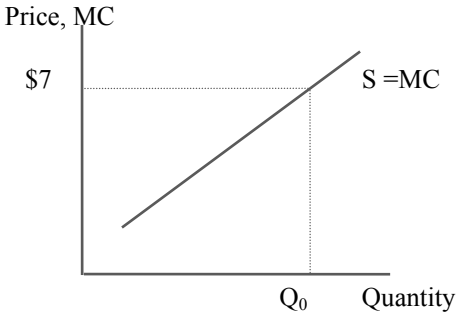
In general,
P > MC - The firm can sell the output for more that it costs. Increase production.
P < MC - It costs the firm more to see the unit of output than it is receives. Decrease production.
P = MC - Just right, stop. The last unit of output is sold for exactly what it costs to produce.

You still don't believe me? Repeat this exercise, and assume the market price is \$5 (P = \$5). The decision rule (picking Q = 3) does indeed maximize profits in this case as well. You would need to recalculate the total revenue and profit columns, but if you do this, you will find that profits are maximized (=\$6).

So, this decision rule is the same as saying that firms will produce until the price from selling the last unit of output is just equal to what it costs to produce the last unit. (P=MC) Or in other words, produce until the marginal costs = price. Our decision rule maximizes profits.

<u>What does the height of a Supply Curve show?</u>

Recollect that a supply curve is a marginal cost curve. Thus, the height of the supply curve at q shows us the marginal cost of producing the qth unit.



At Q_0, the height of the S curve shows us the MC of producing the Q_0th unit, in this case \$7. Thus, the MC of producing the Q_0th unit is \$7.

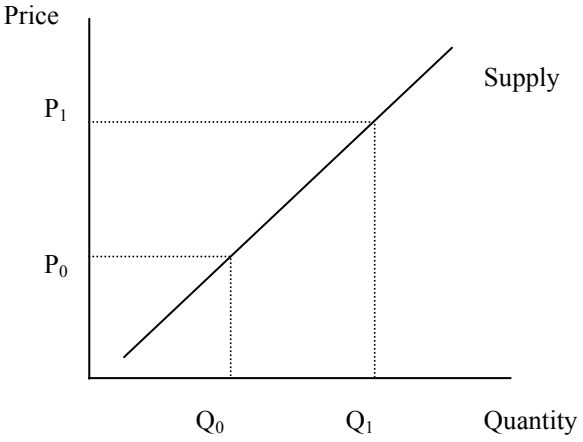
1st Law of Supply

First Law of Supply – Holding other relevant factors constant, (ceteris paribus), the higher the price of a good, the greater will be the quantity supplied. (Supply curves are upward sloping).

This is symmetric. Ceteris paribus, the lower the price of the good, the lower will be the quantity supplied.

A supply curve shows how suppliers (producers) will behave for various possible prices. The 1st Law of Supply simply says that suppliers will want to produce more if they can sell for a higher price.

Changes in the "own price" imply movements along a given supply, that is "changes in quantity supplied". If I am looking at the market for Wayne Newton albums, the own price refers to the price of Wayne Newton albums.



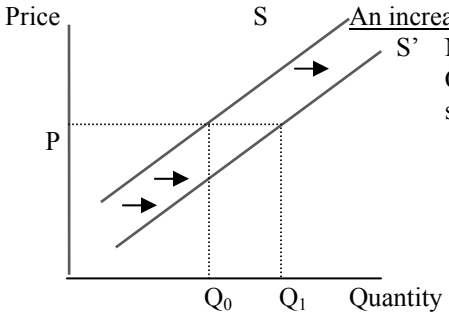
A movement along a supply curve.
At P_0, the quantity supplied will be Q_0.
At the higher price P_1, there will be a higher quantity supplied, Q_1.

Ceteris Paribus Conditions for Supply

1. Input prices – inputs are goods that are used in the production of other goods
   a. Rise in input prices
   b. Fall in input prices

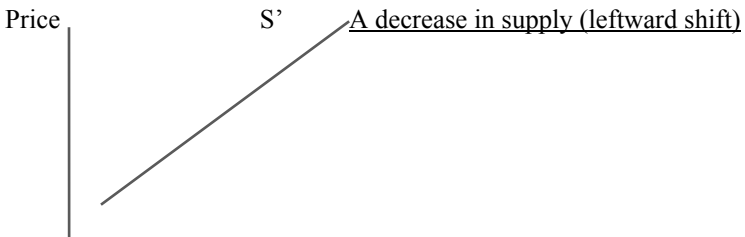
2. Technology
   a. Increases in technology
   b. Decreases in technology

3. "Z vector" – everything else of relevance

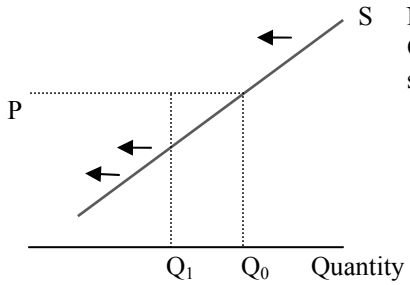


An increase in supply (rightward shift)

Notice at each price, there will be a higher quantity supplied. Originally, at price P, the quantity supplied is Q_0. After the shift, the quantity supplied is Q_1.



A decrease in supply (leftward shift)

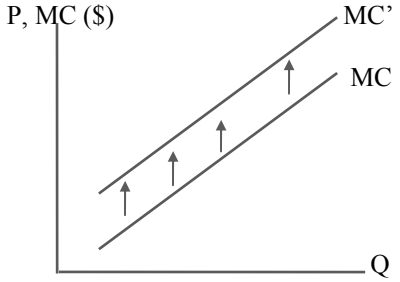


Notice at each price, there will be a lower quantity supplied. Originally, at price P, the quantity supplied is Q_0. After the shift, the quantity supplied is Q_1.

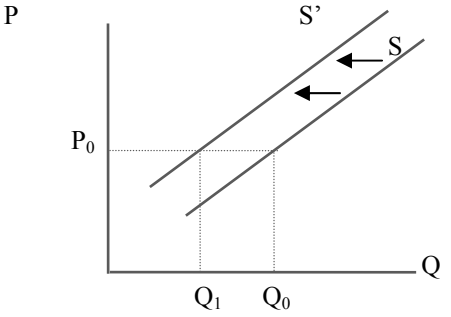
A change in a supply ceteris paribus condition will shift the entire supply curve.

More on Supply curve shifts – which way for what?

An increase in an input price causes an increase in the MC of producing, and hence a decrease in supply.

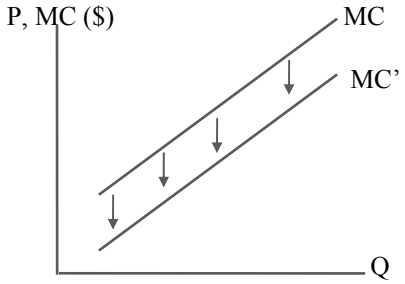


An increase in a input price causes an increase in the marginal cost of producing each unit, and thus shifts up the MC curve.



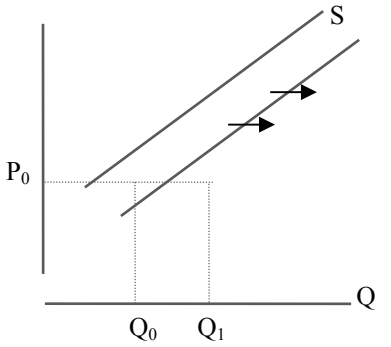
However, we call this upward shift in marginal costs a shift to left of the supply curve (decrease in supply). This is because, at each given price level, firms will be supplying a smaller quantity. Originally, the quantity supplied was Q_0, but after the increase in input price, the quantity supplied is Q_1.

A **decrease in an input price** causes a decrease in the MC of production, and hence an increase in supply.



A decrease in an input price causes a decrease in the marginal costs of producing each unit, and thus shifts down the MC curve.

P



is

However, we call this downward shift in marginal costs a shift S' to the right of the supply curve (increase in supply).This

because at each given price level, firms will be supplying a larger quantity. Originally, the quantity supplied was Q_0, but after the decrease in input price, the quantity supplied is Q_1.

An improvement in technology - improvements in technology are defined as cases where marginal costs are lower due to the technological change. Thus, an improvement in technology is logically the same as a decrease in an input price. Thus, it leads to an increase in supply.

Deterioration in technology – deteriorations in technology are defined as cases where marginal costs are higher due to the change. Thus, these are analagous to an increase in an input price, and thus lead to a decrease in supply.

"Z vector" - everything else e.g. floods, drought, bumper crops
A flood or drought might decrease the supply of corn. A freeze would decrease the supply of oranges. A bumper crop of corn would increase the supply of corn. A law that made it illegal to produce marijuana would decrease the supply of marijuana.

Some phraseology

Change in quantity supplied	Change in supply
Caused only by a change in "own price"	Caused by a change in a ceteris paribus condition
Refers to a movement along a given supply curve	Refers to a shift of the entire supply curve
Must be referred to as a change in quantity supplied	Can be referred to a as an increase in S, a decrease in S, a change in S, a reduction in S, S is lower, S is higher, a shift in S, etc.

Remember, a change in own price causes a movement along a supply curve, and everything else will shift the entire supply curve.

What should I read?

Still chapter 3. Again, avoid the discussion of elasticities for now.