ECO 182: Summer 2015
Production & Cost

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- Production involves a bunch of things. The firm needs to hire "inputs" to produce output. It must pay these "factors of production".
- The firm, will make the very important decision of how much to produce, and whether to actually operate in a market at all. It is not a trivial decision. Firms can make zero output, and remain/exit a market.

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- Remember...the process of using inputs and converting them to output...this is the Technology of a firm.
- A firm(or an industry of many firms) is limited by the technology it has.

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- Example: A firm uses 10 men and one factory to build auto parts. The factory is the *fixed* input.

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- Typical examples of Fixed inputs are: Land, Capital
- As stated earlier, the production of a firm depends on the technology available...and that in a way dictates the choice.

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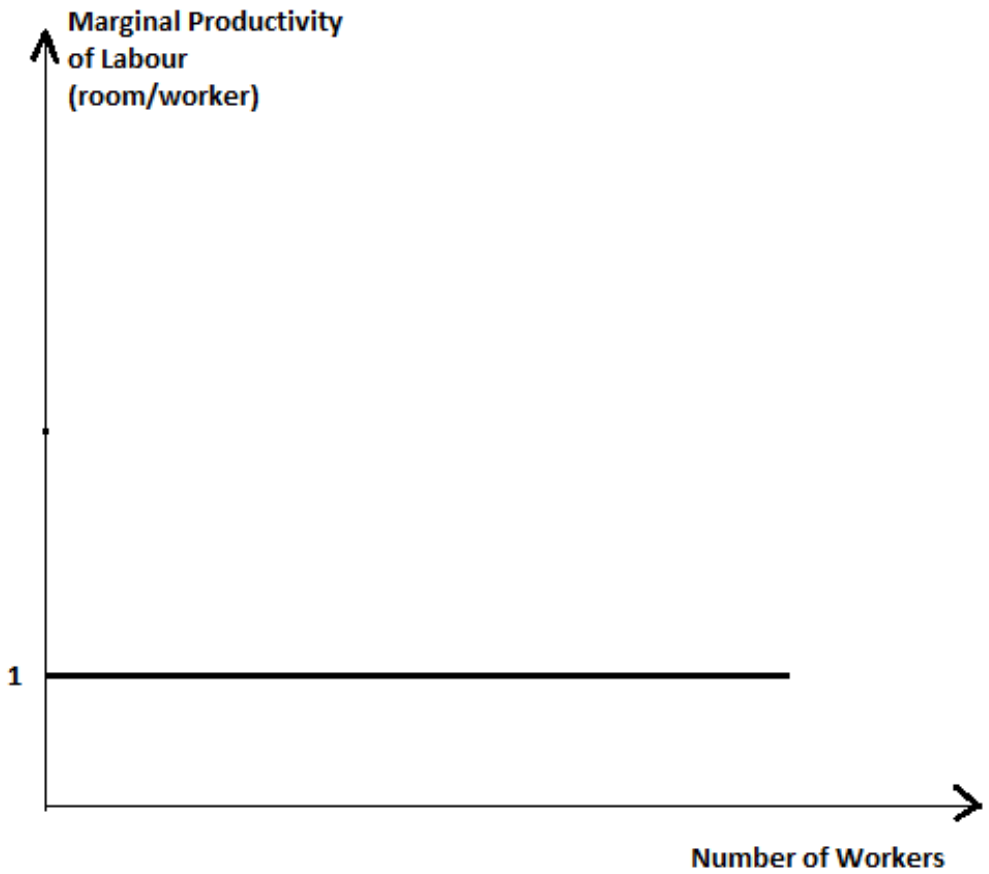
- **Example 1:** 10 workers build a house. Each worker can make one room. MP_L : 1 room/worker. Adding an extra worker doesn't change the number of rooms that worker can make.
- Typically MP is falling in the amount of units used for production.

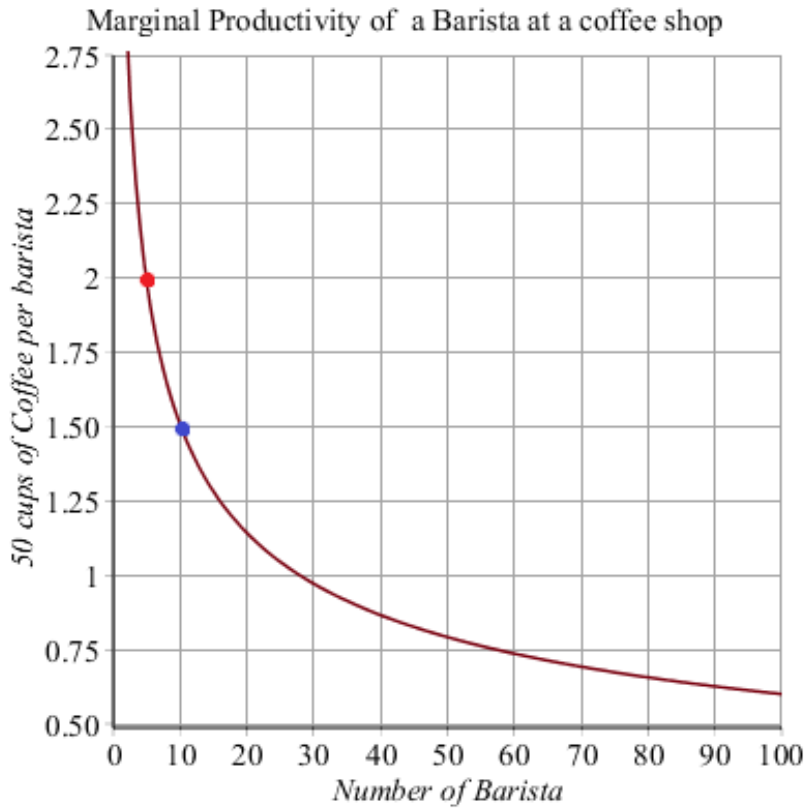
Changing MP

Number of Baristas	Output (50 cups of Coffee)	Change in Output	Change in number of Baristas
0	0	-	-
1	6.3096	6.3096	1
2	9.5636	3.254	1
3	12.1976	2.634	1
4	14.49	2.2924	1
5	16.57	2.08	1

Column(3) from the left gives your *Marginal Product of Baristas*
Column(2) from the left gives your *Total Product of Baristas*

Constant and Diminishing Marginal Productivity





Law of Diminishing Marginal Productivity

Definition: If a firm uses more of a variable input, then eventually the MP of *that* input starts to fall, only when there is atleast one fixed input used by the firm.

- Firm Produces output Y using inputs F, L and K. F is the *fixed* input, L and K are the *variable* inputs. If the firm starts to use more and more of L, then eventually there will come a point, when the MP of L will start to fall.
- Too much crowding: One counter, 200 cashiers.
- Sometimes, inputs are complements...to use more of one input, you need to use more of the other.
- Example: In a bar, number of bottles of whiskey and kegs of beer are fixed. The owner hires 2 new bartenders every hour. Too much crowding.

Average Productivity of Input.

The Average output for the current level of inputs used.

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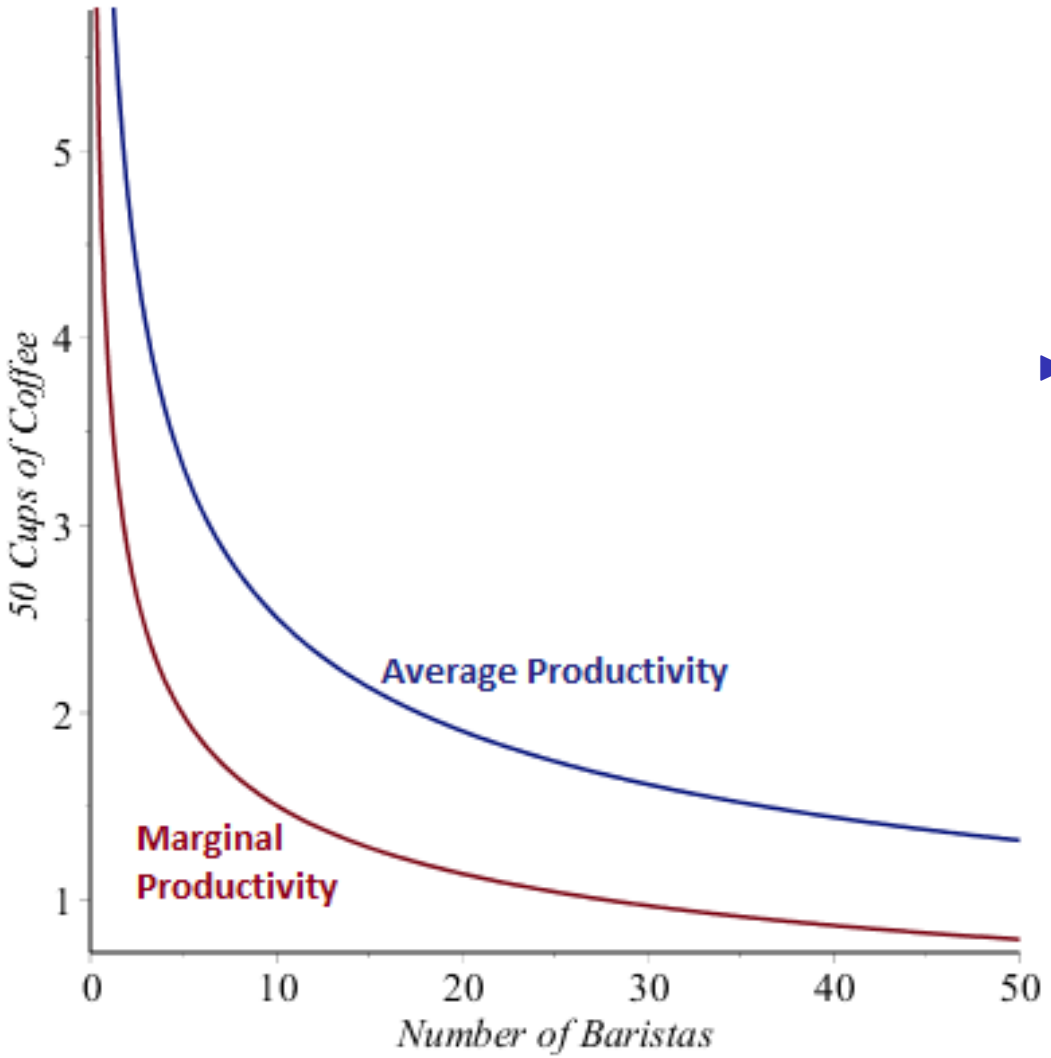

- **Note:** For both the tables on AP and MP, the corresponding graphs should not be continuous but disjoint. You don't need to worry about that yet.

Calculating the Marginal Productivity: Alternate way

Number of Labour	Output	Marginal Productivity
1	1	1
3	2	$1/2 = .5$ each
9	3	$1/6$ each
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- When a firm makes the hiring decision, one of the things it looks at is the productivity of the workers. Similarly for the time when a firm makes the decision to fire a worker.
- This is important, because MP tells the firm, how many extra labour it needs to hire to produce one extra unit of output. This will tell the firm, what it will need to pay this extra labour...i.e. the cost of producing one extra unit of output.

How many worker do I need to hire?

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- After the first 5 units are made, the next additional worker adds 4 extra units of output. So $1/4^{th}$ worker will produce the next unit, i.e. 6th unit of output. So to produce 6 units I need $1\frac{1}{4}$ workers in total.

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- If I hire 4 such $1/4^{th}$ workers, I get the 2nd worker and add an extra 4 units to my existing 5 units of output.

Where do they come from?

The primary source of cost for a firm is the usage of inputs. If a firm hires a labour, it needs to pay that labour; if a firm rents a plot of land to build a factory, then it must pay rent every year on its lease.

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- **Total Variable Cost** of a firm for **a** level of output is the sum of all the VC for **that** level of output.

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- **Average Variable Cost** for **a** level of output is the **Total Variable Cost** for **that** level of output, *divided* by the level of output.
- *Total Variable Cost* at a level of output is the sum of all the MVC up to that level of output.

Calculating the Costs

Making Pizza. Labour Cost($\mathbf{w}$ = \$3 per hour); Cost of Dough ($\mathbf{r}$=\$6 per unit)

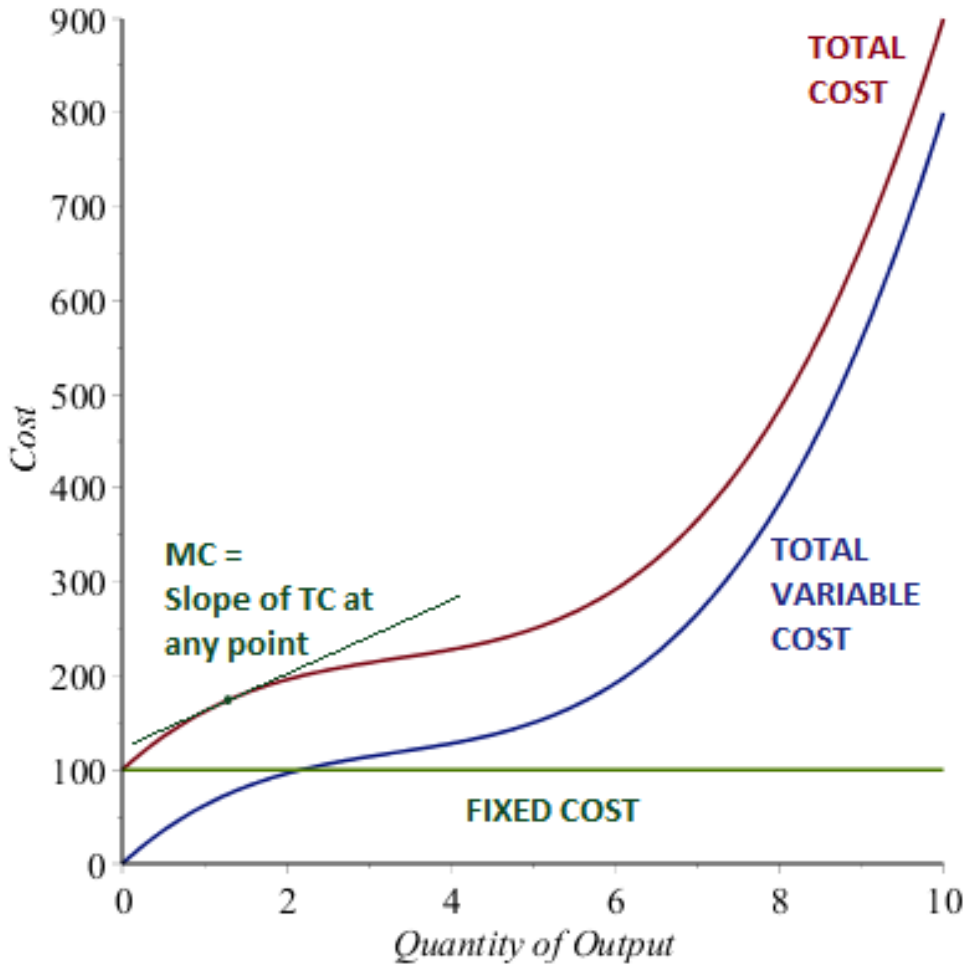
Number of Slices	Number of Labour	Number of Dough	TVC(\$)	FC(\$)
0	0	5	0	30
5	1	5	3	30
9	2	5	6	30
12	3	5	9	30
14	4	5	12	30
15	5	5	15	30

Total Cost(17 slices) =

AVC(12 slices) =

Decomposing Total Cost

- The **TC** of a firm can be broken into two parts, the **TVC** and the **FC**.
  TC = TVC + FC



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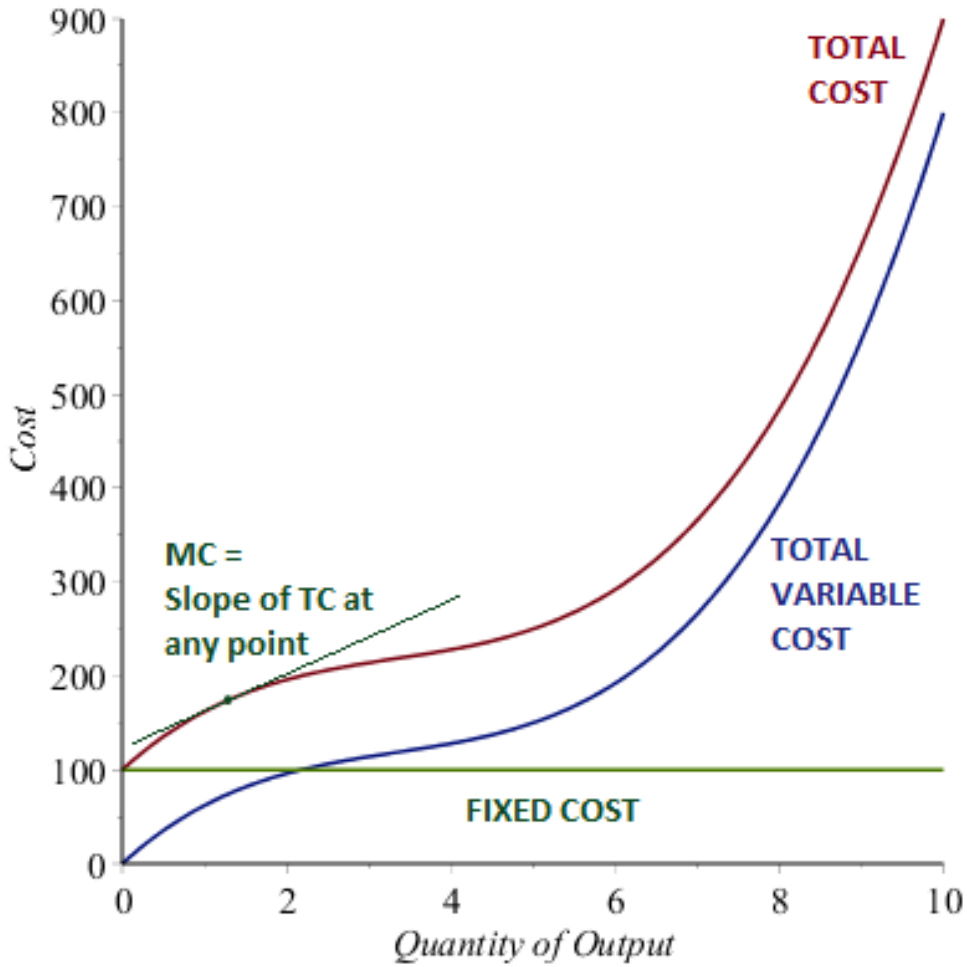

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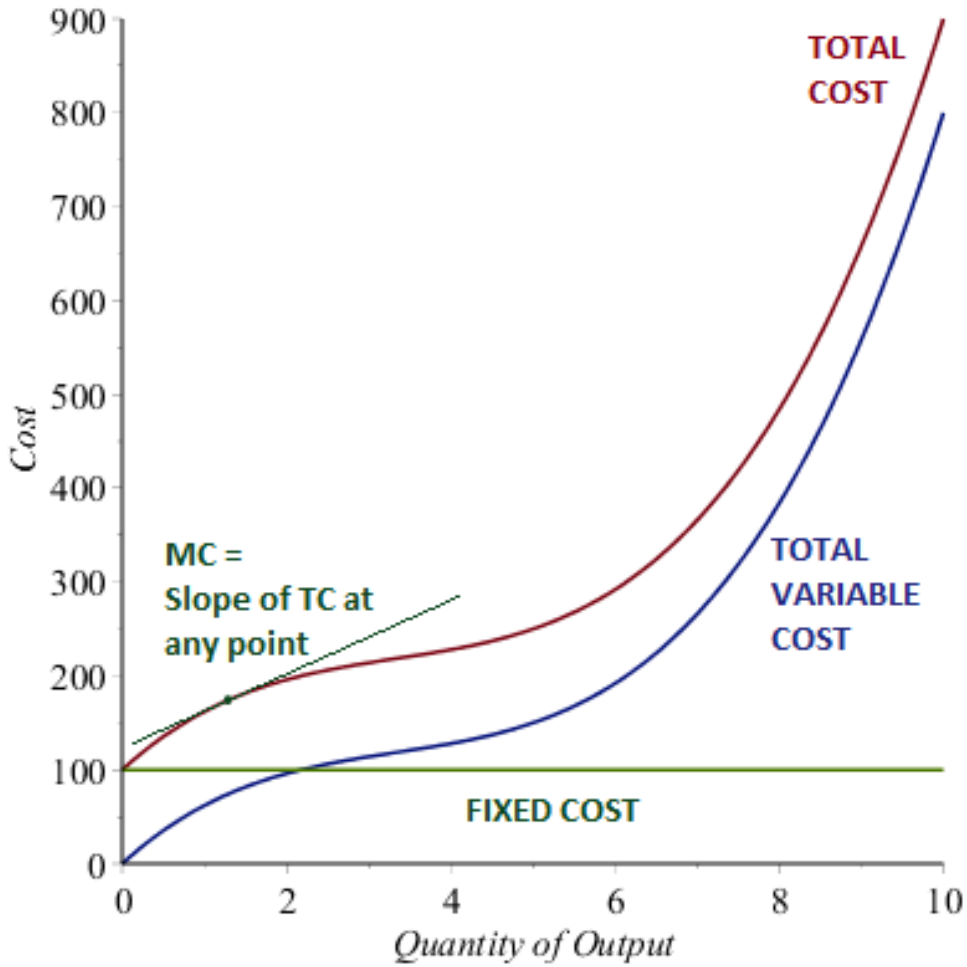
- In fact, the MC is the slope of the TVC at any level of output too!
  Can you say why ?



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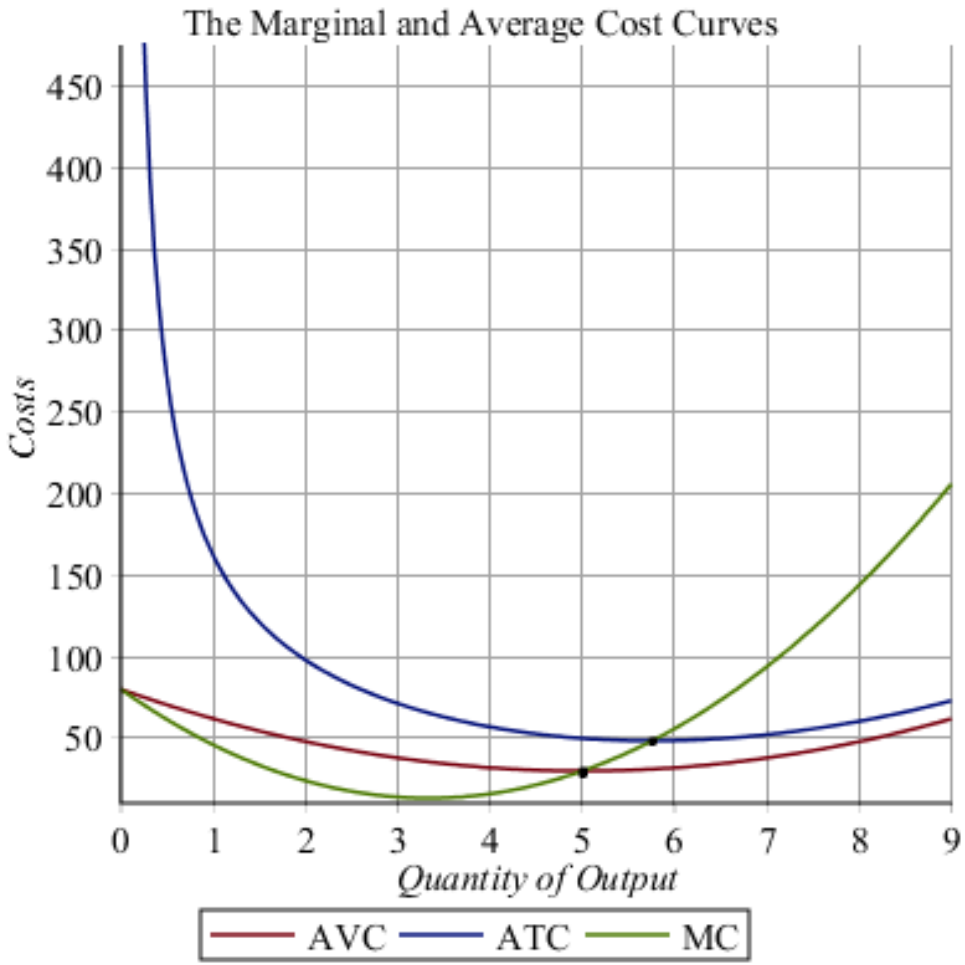

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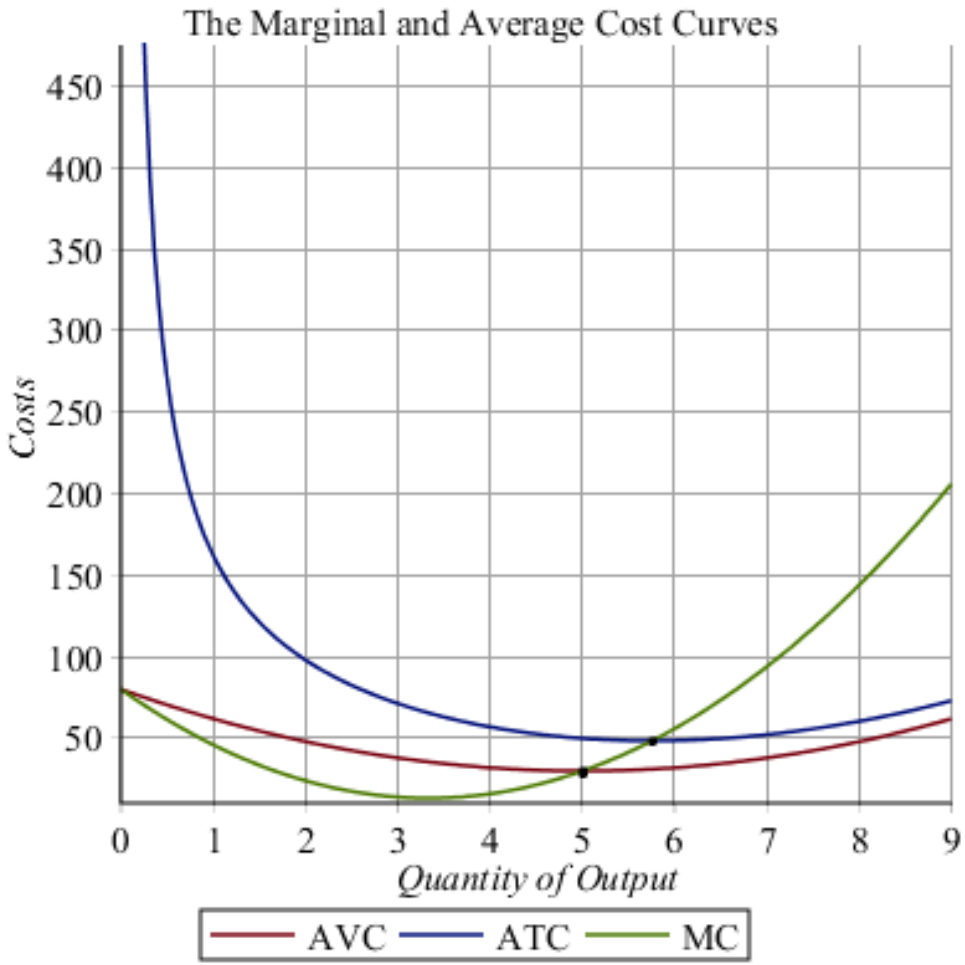

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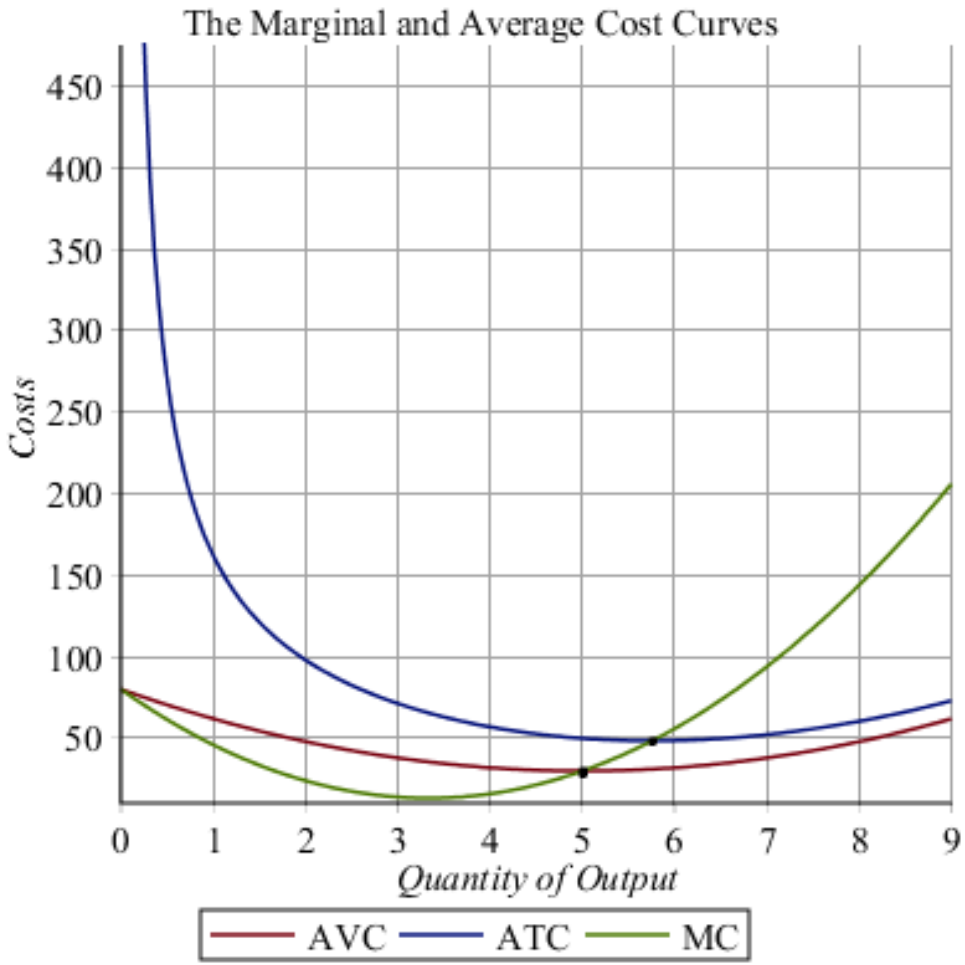

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- When the MC is $>$ than AVC, AVC is rising.
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- The MC, AVC curves drawn correspond to the very special TC curve drawn before. If the TC has some other shape, you might not find the U-shaped AVC, MC curves.

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- Eg: You buy a vacuum cleaner and hire a worker to vacuum floors in an office building. Now say you hire another worker, and then another. The three people take turns and share the vacuum cleaner. Each however covers less floor space than the last one. Why? Because the fixed input, or capital which is the vacuum cleaner is constant. It might not be possible to get an extra vacuum cleaner for some time.

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- If you are manufacturing something in a factory, you can't just build a new factory next day to increase production.

Short and Long Run

- The concept of **Short Run** is as follows: It takes some time to change the amount of inputs used. These inputs are fixed in this duration. How long is the duration? Could be a week, a month, a year or two...depending on what type of inputs we are talking about.

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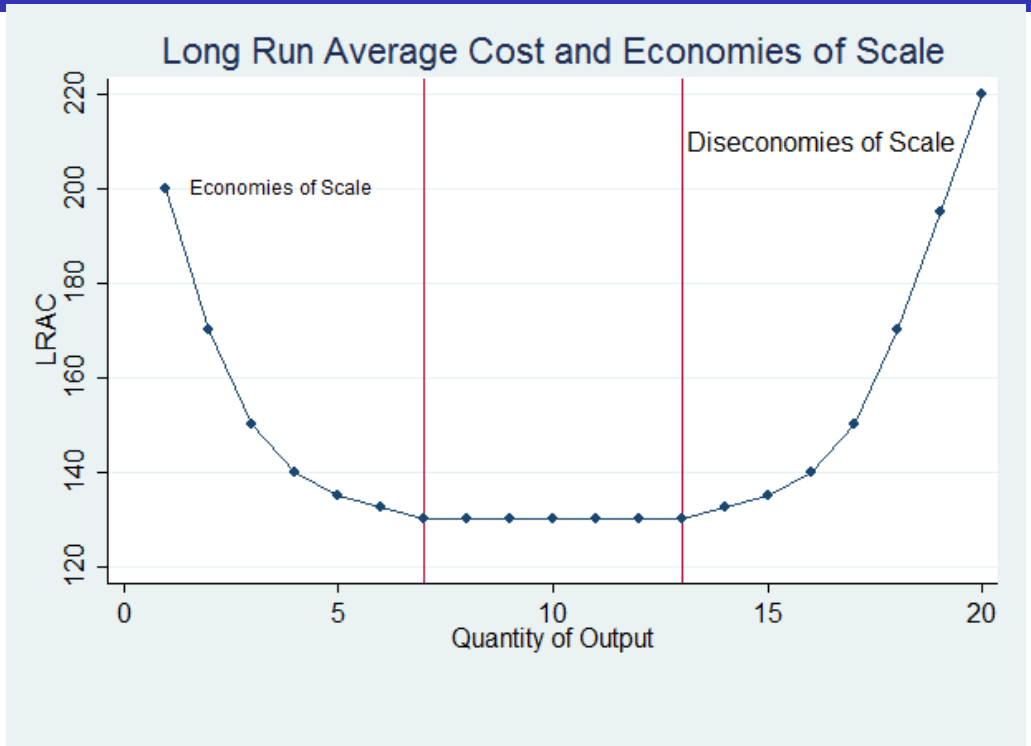
- In the **Long Run**, all inputs are variable.
- The question is: How long is the Short Run before we have Long Run?
  It depends. Long run could set in after 1 year, 5 years or 10. The idea is that you understand, in which case you will have fixed inputs.

Economies of Scale

- At smaller levels of output in the LR, firms may be able to enjoy a lowering of costs through expanding their production, through better use of inputs. This is *Economies of Scale*.



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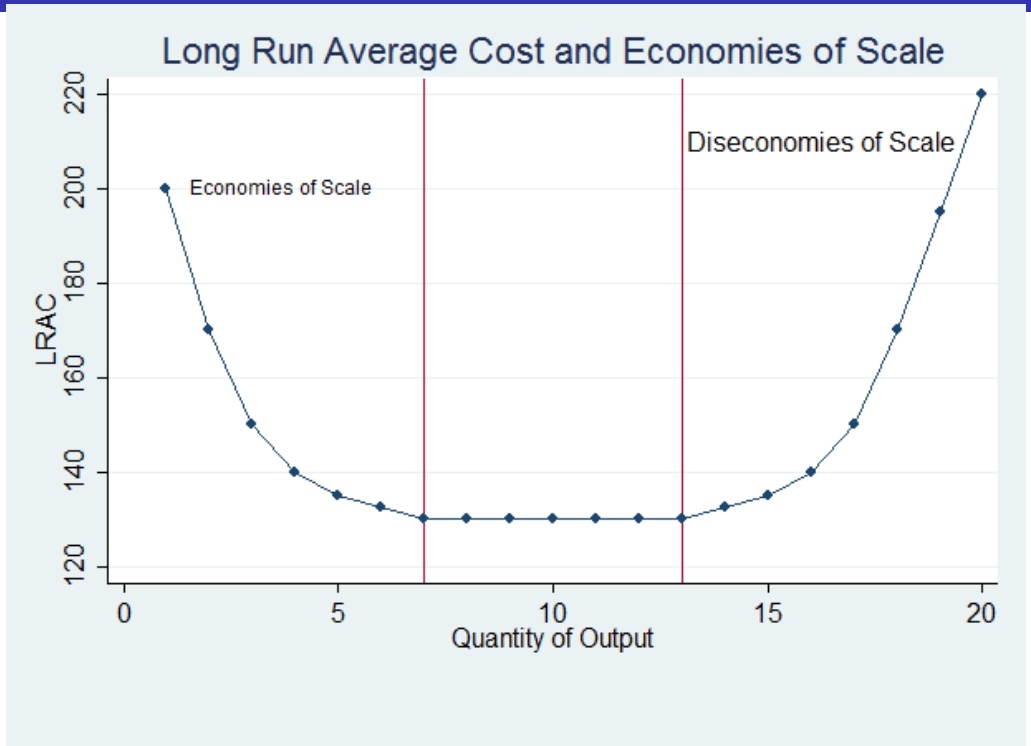

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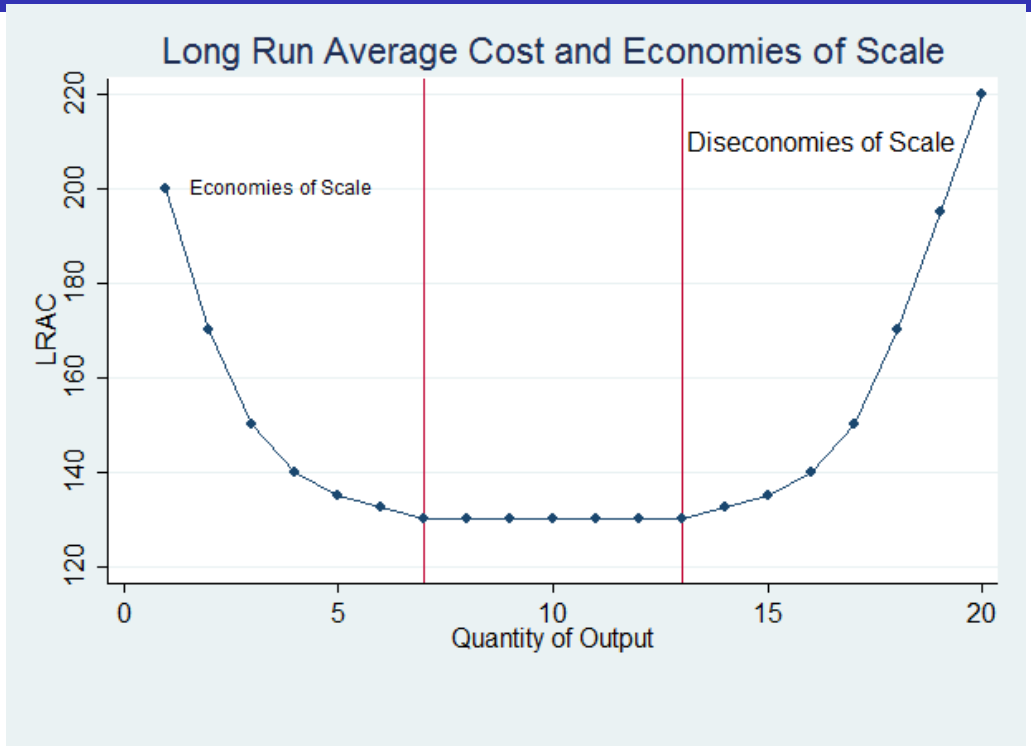

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