AEM 102: Principles of Economics

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SUNNYWISE

Lecture 9

COST OF PRODUCTION

Course Outline

- Explicit costs, implicit costs and economic profit
- The law of diminishing returns
- Short run Total Costs
- Short run per unit costs
- Long run production costs
- Constant, increasing and decreasing returns to scale

Explicit costs, implicit costs and economic profit

- Discussion will be focus on the firm's production costs ie what lies behind the firm's supply curve
- Explicit costs are the actual, out of pocket expenditures of the firm to purchase or hire the services of the factors of production it needs
- Implicit costs are the costs of the factors owned by the firm and used in its own production processes
- These costs should be imputed or estimated from what these factors could earn in their best alternative use or employment
- In economics, costs include both explicit and implicit costs
- Profit is the excess of revenues over these costs

- The explicit costs of a firm are:
- the wages it must pay to hire labor,
- the interest to borrow money capital
- the rent on land and
- buildings used in production process

IMPLICIT COST

- Implicit costs are the costs of the factors owned by the firm and used in its own production processes

- To these, the firm must add such implicit costs such as the:

- wage that the entrepreneur would earn as a manager for somebody else,

- the interest he would get by supplying his money capital if lent to someone else in a similarly risky business,

- the rent on his owned land and buildings, if he were not using them himself

Economic or Pure Profit

- Achievable only if:

- total revenue received from selling the output exceeds both its explicit and implicit costs is the firm making an economic or pure profit

THE LAW OF DIMINISHING RETURNS

- The law of diminishing returns is one of the most important and unchallenged laws of production

- It states that:

- as we use more and more units of some factors of production to work with one or more fixed factors of production, after a point we get less and less extra or marginal output or product from each additional unit of the variable factor used

SHORT RUN AND LONG RUN

- **Short run:** is the time period when at least one factor of production is fixed in quantity ie cannot be varied is referred to as the short run

- Thus the law of diminishing returns is a short run law

- **Long run:** is the period of time when all factors of production are varied. In the long run, all inputs are variable, the distinction between variable cost and fixed cost disappears for all practical purposes.

- It is a period which is sufficiently long to permit desired adjustment to the size of plot or enterprise, size of capital investment, type of production technology to adopted etc

Illustration: Law of Diminishing Return

Variable factor labour, (persons)	Total Product(Tons/year)	Marginal Product
0	0	
		3
1	3	
		5
2	8	
		4
3	12	
		3
4	15	
		2
5	17	

Example

- Table shows the total and marginal product of using each additional unit of labor on the same land (fixed factor of production), say one hectare of land.

- Note that with zero labor, TP= 0

- By adding the second unit of labor, TP=3 and MP, the unit change in TP=3

- By adding the second unit of labor, TP=8 and MP=5

- The 3rd unit of labor leads to a TP of 12 and MP of 4

- The law of diminishing returns begins to operate in this example with the addition of the 3rd unit of labor

SHORT RUN COST

- Though total cost are very important, per unit costs or average costs are even more important in the short run analysis of the firm

- In the short run, there are total fixed costs, total variable costs and total costs

- Total fixed costs, TFC are the costs which the firm incurs in the short run for its fixed inputs.

- These are constant regardless of the level of output and whether it produces or not

- An example of the TFC are salaries of permanent staff, fixed expenses of fixed capital, Depreciation of fixed assets.

- TVC are the costs incurred by the firm for the variable inputs it uses.
- These costs varies directly with the level of output produced.

- Examples of TVC are cost of raw material, costs of labour , running costs of fixed assets.

- Total costs (TC) are equal to the sum of total fixed costs and total variable costs. It is the total cost of producing a given output

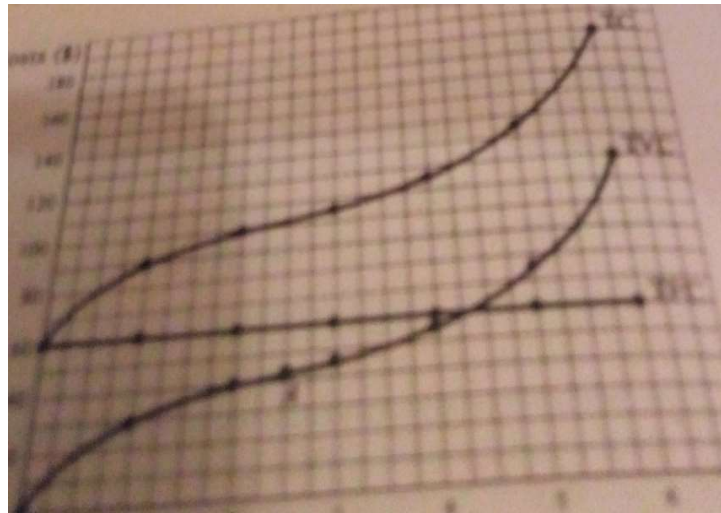# HYPOTHETICAL TFC,TVC and TC SCHEDULES FOR VARIOUS OUTPUTS,Q

Q	TFC(N)	TVC(N)	TC(N)
0	60	0	60
1	60	30	90
2	60	40	100
3	60	45	105
4	60	55	115
5	60	75	135
6	60	120	180

Graph of TFC, TFC and TC
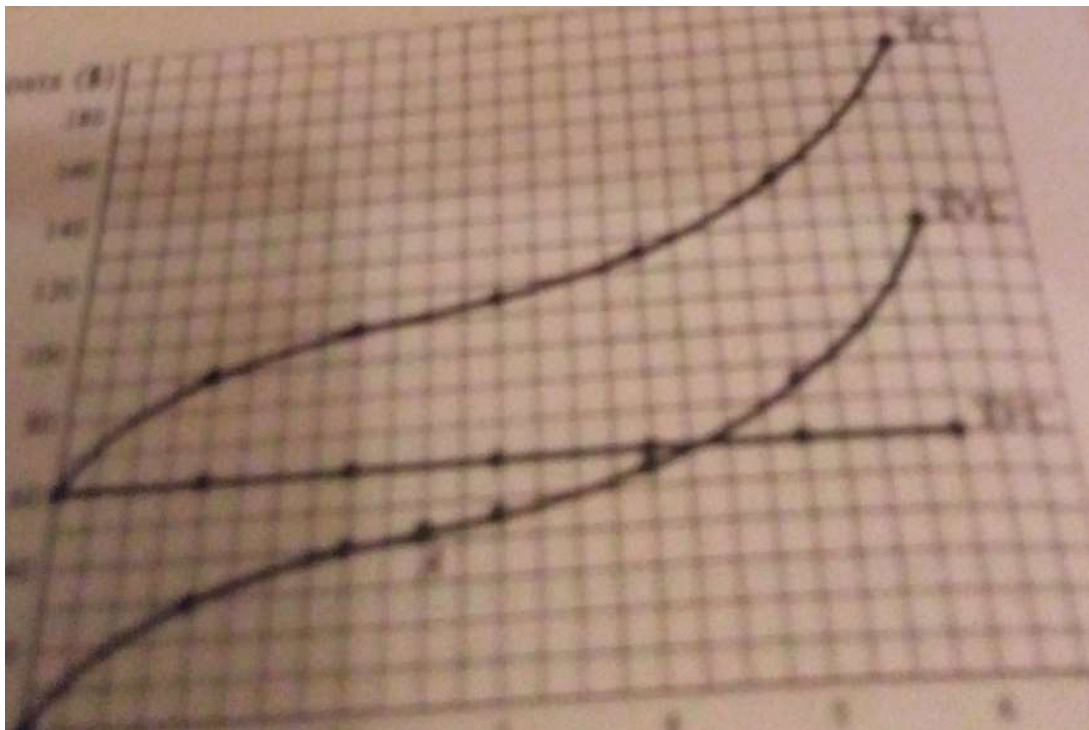
Total Fixed Cost (TFC)

- See that regardless of the level of output, TFC is 60
- It is reflected in the figure in a TFC curve which is parallel to the quantity axis and N60 above it

Total Variable Cost (TVC)

- TVC is zero when output is zero and rises as output increases

- The shape of TVC curve follows from the law of diminishing returns

- Up to point A the firm is using so few of the variable inputs together with its fixed inputs that the law of diminishing is not yet operating

- Therefore, TVC increase at a decreasing rate and TVC curve faces down

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- Past point A, the law of diminishing returns begins to operate, so that TVC increase at an increasing rate and TVC curve faces up

- At every output level, TC equals TFC plus TVC

- For this reason, the TC curve has the same shape as the TVC curve and in this case , is every where N60 above it
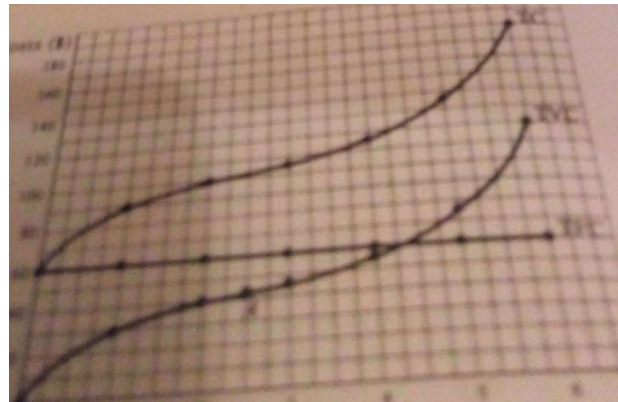
SHORT RUN PER UNIT COSTS

Though total cost are very important, per unit costs or average costs are even more important in the short run analysis of the firm

- The short run per unit costs that we consider are the:
- Average Fixed Costs,
- Average Variable Costs and
- Average Total Costs
- and Marginal Cost

- Marginal cost (MC) is the addition to total cost due to the production of an additional unit of total product

- AFC equals total fixed cost divided by output i.e TFC/Q

- AVC equals total variable cost divided by output i.e TVC/Q

- AC equals total costs divided by output i.e TC/Q

- AC also equals AFC plus AVC i.e AFC + AVC

- MC equals the change in TC per unit change in output i.e $\dfrac{\Delta TC}{\Delta Q}$

TFC, TVC. TC, AFC, AVC,AC and MC schedules

1	2	3	4	5	6	7	8
Q	TFC	TVC	TC	AFC	AVC	AC	MC
1	60	30	90	60	30	90	-
2	60	40	100	30	20	50	10
3	60	45	105	20	15	35	5
4	60	55	115	15	13.75	28.75	10
5	60	75	136	12	15	27	21
6	60	120	180	10	20	30	44

Table presents AFC,AVC,AC and MC schedules derived from TFC,TVC and TC

- AFC column(5) is obtained by dividing TFC(2) by corresponding quantities of output Q(1)

- AVC schedule(6) is obtained by dividing TVC(3) by output Q(1)

- AC schedule(7) is obtained by dividing TC(4) by output Q

- AC at every output level also equals AFC(5) plus AVC(6)

- MC schedule(8) is obtained by subtracting successive values of TC(4)

- Thus MC does not depend on the level of TFC

GRAPH OF AFC, AVC, AC and MC

Fig. 16-2
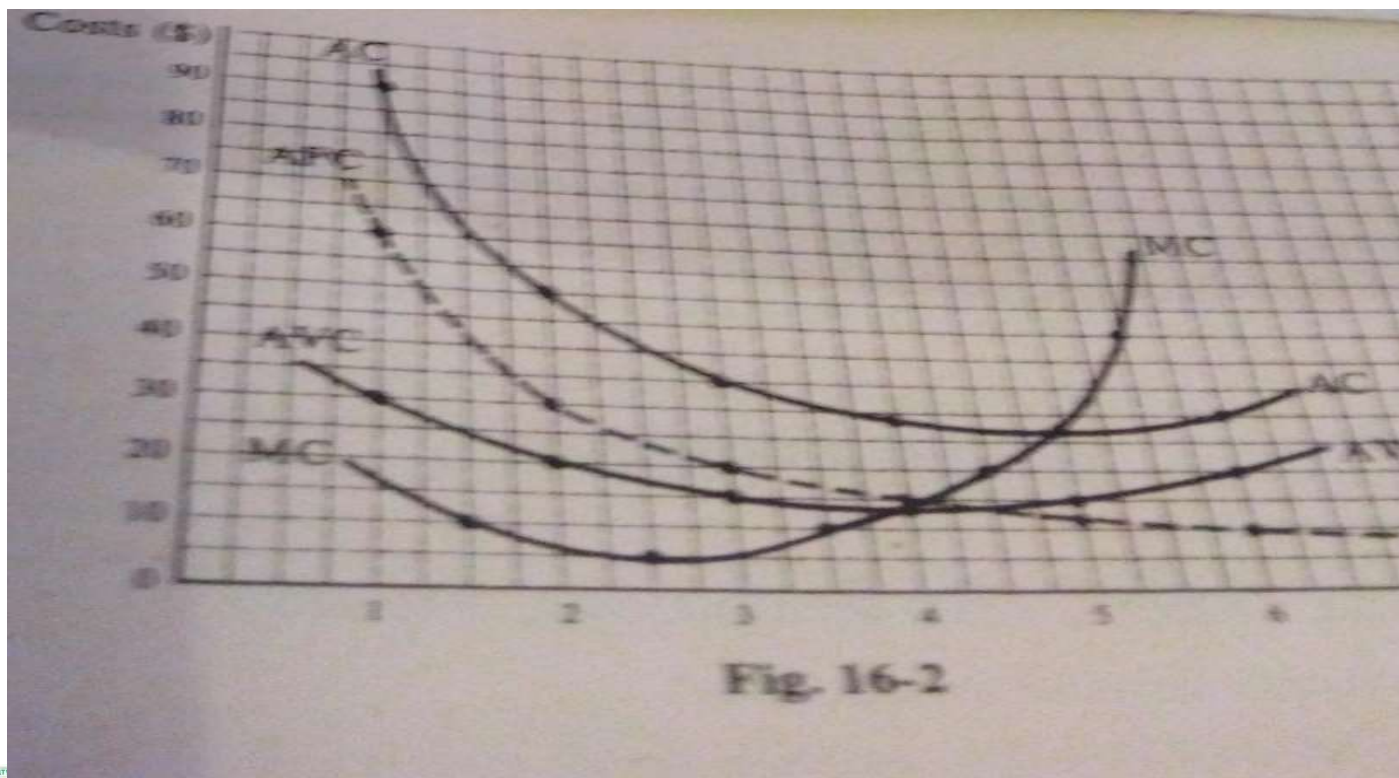
- Note that the values of the MC schedule are plotted half-way between successive levels of output
- Also note that while the AFC curve falls continuously as output is expanded,
- the AVC, the AC and the MC curves are U-shaped
- The MC curve reaches its lowest level of output than either the AVC curve or the AC curve
- Also the rising portion of the MC curve intersects the AVC and AC curves at their lowest points

LONG RUN PRODUCTION COSTS

- Long run is the period of time when all factors of production are varied.
- In the long run, there are no fixed factors, all inputs are variable, and hence the size of enterprise (plant) becomes variable.

- A firm's long run cost curve gives the minimum cost of producing each level of output.

- Once a particular short run cost curve is chosen, only short-run analysis become relevant bcos actual production takes place only in the short run.

- Thus, the long run cost curve(LAC) is no more than a combination of short-run cost curves(SAC)

- Each point on the long run cost curve (LAC) represents a point on a corresponding short run cost curve (SAC) which is tangent to the LAC at that point

- The LAC curve is thus formed from the relevant segment of the SAC curves.

- Except at the point of tangency where LAC=SAC, an LAC is lower than its corresponding SAC.

- Hence, LAC is sometimes referred to as the 'envelop' curve bcos it envelopes SAC curves

- LAC curve is the locus of these points of tangency

- LAC curve is U-shape

HYPOTHETICAL PLANT SIZES THAT FIRM COULD BUILD IN THE LONG RUN

Fig. 16-7
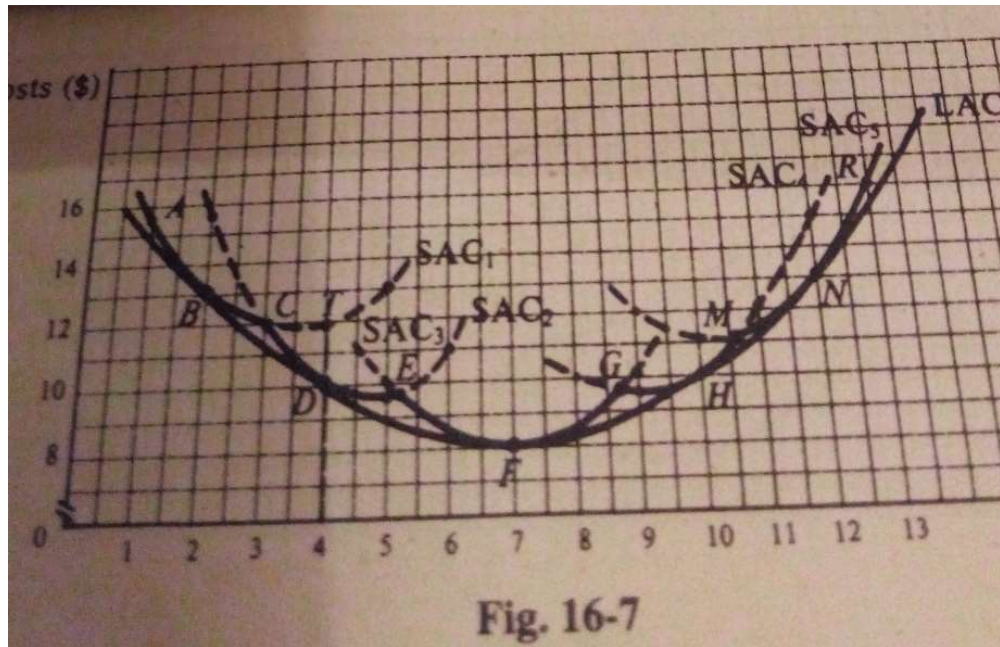
RETURNS TO SCALE

- The concept of returns to scale focuses on the rate at which an output changes when all factors of production (inputs) change simultaneously.
- The concept of returns to scale is a long run one because it is only in the long run that all production inputs are variable.
- It measures the percentage change in the quantity of an output produced when the quantities of all production inputs change by one percent.
- The scale coefficient is a positive number which may be greater than unity, equal to unity or less than unity.
- Greater than unity (>1) = Increasing returns to scale
- Equal to unity (=1) = constant returns to scale
- Less than unity (<1) = decreasing returns to scale

- **Increasing returns to scale**- if the quantities of all inputs are increased by one percent, the quantities of output produced increases by more than one percent.

- **Constant returns to scale**- occurs when the quantity of an output produced increases by the same proportion as that of all inputs.

- **Decreasing returns to scale**- occurs when the quantity of output produced increases by a lower proportion than that of all inputs

- Increasing returns to scale or economies of mass production may result because of division of labor and specialization in production

- Beyond a certain size, however, management problems resulting in decreasing returns to scale may arise

1.Brain teasers

(a). Why do we study a firm's cost of production?

(b). Distinguish among opportunity costs, explicit costs and implicit costs?

©. Distinguish between the short run and the long run periods in production.

(d). How long is the long run?

2.TEAZERS

- 2. Suppose that a tailor working alone can make 2 suits/month, 2 tailors working in the same shop can produce 5 suits, 3 tailors 10 suits,4 tailors 14 suits,5 tailors 17 suits and 6 tailors 19 suits
- (a).Find the marginal product of labor
- (b). When does the law of diminishing returns begin to operate?
- ©. Why do you have increasing returns up to that point?
- (d). Why do diminishing returns eventually set in?

Solution

Number of tailors	Number of suits TP/MONTH	MARGINAL SUITS MP
0	0	2
1	2	3
2	5	5
3	10	4
4	14	3
5	17	2
6	19	

- From the Table above:
- B. The law of diminishing returns begins to operate with the addition of the fourth tailor.
- Up to that point, the shop is underutilized. Since a single tailor could either be taking measurements, cutting the fabric, or sewing the suit together, most of the equipment in the shop is idle most of the time
- As we go from 1 to 2 and then to 3 tailors, one tailor could be taking measurements most of the time, a second cutting the fabric and the third sewing so that the workers and equipment are in use almost constantly
- In addition each tailor can now specialize and become more productive by performing only one specific routine

- C. Adding the 4th tailor to the same shop does not increase the number of suits proportionately ie by one quarter but by less.

- There is now not enough equipment in the shop to keep all 4 tailors fully occupied all the time. The shop is also becoming too crowded and too much conversation may start going on.

- Diminishing returns have set in and they become even smaller as still more tailors are added to the shop.

3.TEAZER

- A firm pays N200K in wages,N50k in interest on borrowed money capital and N70K for the yearly rental of its factory building.

- If the entrepreneur worked for somebody else as a manager she would earn at most N40k/year, and if she lent out her money capital to somebody else in a similar risky business, she would at most receive N10k/yr

- She owns no land or building

- Calculate the entrepreneur's profit if she received N400k from selling her year's output

- How much profit is the entrepreneur's earning from point of view of the person on the street?

- To what is the difference in the results due?

- What will happen if the entrepreneur's total revenue were N360k instead?

Solution

- a .The explicit costs of the entrepreneur are N320k,(N200k in wages, plus N50k in interest plus N70k in rent)

- Her implicit costs are N50k(N40k in wage sin her alternative employment plus N10k interest on her money capital)

- Her total costs ,explicit plus implicit are N370k,

- Since the total revenue from selling the years output is N400k, this entrepreneur earns a pure or economic profit of N30k for the year

- b. The person on the street would instead say that this entrepreneurs profit is N80k(the total revenue of N400k minus the out of pocket expenditures, or explicit costs of N320k).

- However N50k of this N80k represents the normal return on the entrepreneurs owned factors and is approximately considered a cost by the economist

- C. If the entrepreneurs total revenue were N360k she would earn less than a normal return on her owned factors (her wage and interest in the best alternative employment) and it will pay for her to go out of business and work as a manager for and lend her money to someone else

- This clearly shows that implicit costs are indeed part of costs of production because they must be covered in order for the firm to remain in business and continue indefinitely to supply the goods or services it produces