**Long Run Marginal and Average Cost**

Profit maximizing firm that makes output decision asking question: does the additional revenue from increased output cover the extra costs?

Marginal Cost

 Change in total cost resulting from producing additional unit of output

 Cost of decision to change output

Firm’s production function:

Q = F(K,L) = K1/2­L1/2

TC = 2Q(rw)1/2

Long run marginal cost: LMC = $\frac{∂TC}{∂Q}$ = 2(rw)1/2

MC will not vary with output

 Rate at which total cost increases with output does not vary with output

For our representative firm, what would cause a change in Long Run Marginal Cost?

Can we use our function to determine how much total cost will rise if the next unit is produced?

TC

TC

Q

LMC

LMC=LAC

Q

Long run average cost - LAC = $\frac{TC}{Q}$

reflects returns to scale

If returns to scale are constant, fraction would be unchanged with output - LAC = $\frac{2Q(rw)^{1/2}}{Q}$ = 2(rw)1/2

 For the particular production function, LAC is constant, equals LMC

What characteristic of our function gives rise to LAC=LMC?

Why is LAC a measure of returns to scale? Why not LMC?

Confirm that our representative firm never benefits from increasing returns to scale. Explain why this is odd.

Some industries firms found to exhibit LAC function:

Cost

Q

LMC

LAC

Increasing returns

Decreasing returns

What is the rationale increasing returns to scale?

What is the rationale for decreasing returns to scale?

Under decreasing returns, what is rising faster, Costs or Output?

Relationship between marginal and average

Studies have estimated many long run average cost curves to show no evidence of decreasing returns

LAC

Cost

Q

[Empirical Evidence of Returns to Scale](http://milesfinney.net/410/handout/long.pdf)

Short run

Time period in which at least one factor of production is held fixed

Example: labor contract, lease on building

In short run, firm likely will not operate at least cost

What condition holds for least cost production?

Why would the presence of fixed factors suggest the firm would likely not be operating at least cost?

Bicycle firm:

Q=F(K,L) = K1/2L1/2

Assume capital is fixed at K0=80

r=$5 w=$20

Q0 = 50 Q1 = 60

[Illustration in short run](http://milesfinney.net/410/handout/shortrun.pdf)

Cost minimizing production of Q0, Q1 at a and a’ input mixes.

[Calculate STC1 and STC2](http://milesfinney.net/410/handout/STC.pdf)

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Short run cost function

STC = variable cost + fixed cost

STC = wL + rK0 ­ Capital fixed K0 = 80

Convert to function of output and input prices

Q = K1/2L1/2 → Q2 = KL → L = Q2K-1

Substitute:

STC = wL + rK0

 =w Q2$K\_{0}^{-1}$+ rK0

Substitute for values of r, w and K0

1. Confirm short run total cost for points b and b’
2. Calculate short run marginal cost – MC
3. Calculate short run average cost – SAC = STC/Q = AVC+AFC

AVC – average variable cost

AFC – average fixed cost

|  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- |
|  | Total Cost |  | Average Cost |  | Marginal Cost |  |
| Output | LR | SR | LR | SR | LR | SR |
|  |  |  |  |  |  |  |
| 50 |  |  |  |  |  |  |
| 60 |  |  |  |  |  |  |

Why are costs always higher in the short run?

What is the cost of the "lumpy" decision to increase output from 50 to 60 in the short run and long run? How do your answers relate to the marginal costs calculated for points *b* and *b’*?

Short run marginal cost may also be defined as follows:

 where labor is assumed the only variable input.

Derivation: STC = wL + rk0

MC = $\frac{∆TC}{∆Q}$ = $\frac{∆wL}{∆Q}$ = $\frac{w∆L}{∆Q}$ = $\frac{w}{^{∆Q}/\_{v∆L}}$ = $\frac{w}{MPL}$

Confirm the above function could calculate short run marginal cost.

Law of Diminishing Returns states that marginal product of variable factor at some point must begin to diminish

Implies MC must at some point begin to increase

Cost

MC

Q

Bicycle Producer

SAC

q\*

Diminishing returns arises immediately for producer

Relationship between marginal/average cost

 Average cost is falling as long as marginal cost is less than average cost

 SAC is at minimum where MC=SAC, at q\* (find q\*)

K

L

Q

e

80

20

 Input mix:

 K=80 L=20 is least cost method to produce Q=40

Relationship between long run/short run average costs

LAC

Output

SACk=80

SACk=200

100

cost

40