Tuesday, October 04, 2011
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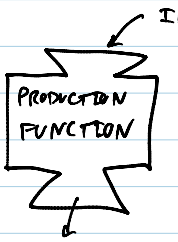
THEORY OF PRODUCTION AND COSTS



$Q = F(L, K)$ (INPUTS)

WHERE Q = QUANTITY OF OUTPUTS (UNIT / TIME PERIOD)

L = QUANTITY OF LABOR (UNIT / TIME PERIOD)

K = QUANTITY OF CAPITAL (UNIT / TIME PERIOD)

" LIKE = COOKING RECIPE

OUTPUT

- **PRODUCTION FUNCTION:** THE RELATIONSHIP THAT DESCRIBES HOW INPUTS LIKE CAPITAL AND LABOR ARE TRANSFORMED INTO OUTPUT.

- **SHORT RUN:** THE LONGEST PERIOD OF TIME DURING WHICH AT LEAST ONE OF INPUTS USED IN PRODUCTION CANNOT BE VARIED

- **LONG RUN:** THE SHORTEST PERIOD OF TIME REQUIRED TO ALTER THE AMOUNTS OF ALL INPUTS USED IN PRODUCTION PROCESS.

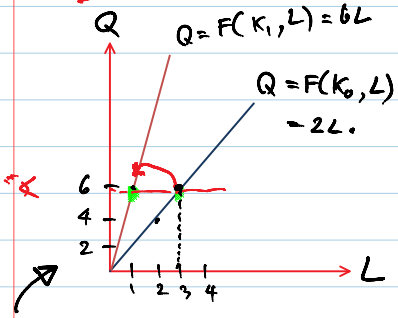
OR PERIOD OF TIME THAT ALL INPUTS CAN BE VARIED.

EX: $Q = F(L, \bar{k})$ (VARIABLE INPUT, FIXED INPUT) $\Rightarrow$ SHORT RUN PROD. FN.

$Q = F(L, K) \Rightarrow$ LONG RUN PROD. FN.

FIXED INPUT: AN INPUT THAT CANNOT VARIED IN THE SHORT RUN

VARIABLE INPUT: AN INPUT THAT CAN BE VARIED.



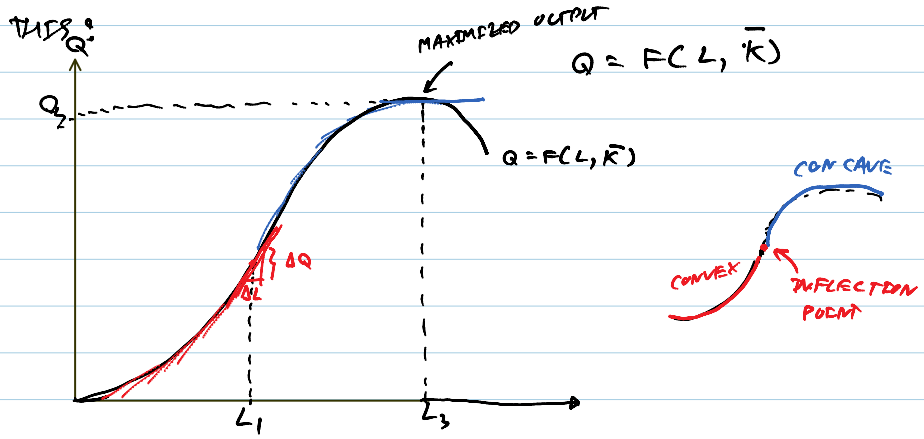
AN EXAMPLE OF PRODUCTION FUNCTION.

- $Q = 2KL$ WHEN K IS FIXED
  - AT $K_0 = 1$, $Q = 2L$
  - WHAT IF $K_1 = 3$? $Q = 2 \cdot 3 \cdot L = 6L$.

SO FAR, YOU HAVE SEEN A STRAIGHT LINE PRODUCTION FUNCTION. BUT THE COMMON SHAPE OF PRODUCTION FUNCTION WE HAVE SEEN IN PRACTICE IS LIKE THIS:

Q (MAXIMIZED OUTPUT) $Q = F(L, \bar{K})$

FUNCTION WE [illegible]



OBSERVATION #1 WHEN $L = 0$, $Q = 0$.

OBSERVATION #2 WHEN $L = L_3$, Q IS MAXIMIZED AT $Q = Q_3$.

OBSERVATION #3 BEYOND $L = L_3$, INCREASE IN L LEADS TO DECREASE IN Q.
(A RATIONAL MANAGER WILL NOT USE L BEYOND L_3.)

OBSERVATION #4: FROM $L = 0$ TO $L = L_1$:
WHEN L INCREASES, Q INCREASES AT INCREASING RATE.

FROM $L = L_1$ TO $L = L_3$:
WHEN L INCREASES, Q STILL INCREASES AT DECREASING RATE.

IN CONNECTION TO THIS OBSERVATION, WE DEFINE

MARGINAL PRODUCT (OF LABOR): MP_L

$$MP_L = \frac{\Delta Q}{\Delta L} = \frac{\text{CHANGE IN AMOUNT OF OUTPUT}}{\text{CHANGE IN AMOUNT OF WORKERS}}$$

NOTICE THAT: SLOPE OF PRODUCTION FUNCTION ABOVE IS MP_L.

(CONTINUED)

RECAP:

- TOTAL PRODUCT (TP) OR Q OR OUTPUT
- AVERAGE PRODUCT (AP_L) = $\frac{TP}{L}$ OR $\frac{Q}{L}$

EX: Q = 1000 COOKIES / DAY
L = 5 WORKERS

$AP_L = \frac{Q}{L} = \frac{1000}{5} = 200$ COOKIES / WORKER

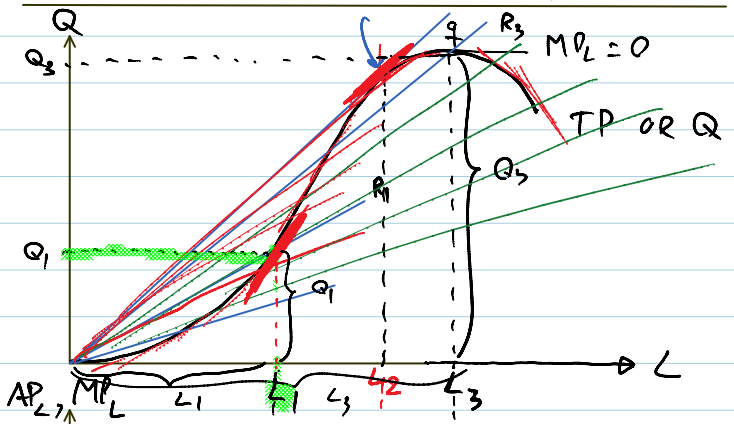
$AP_L = \frac{Q}{L} = \frac{1000}{5} = 200$ COCONUTS/WORKER

= "LABOR PRODUCTIVITY"

- MARGINAL PRODUCT OF LABOR (MP_L) $= \frac{\Delta Q}{\Delta L}$

$= \frac{Q_2 - Q_1}{L_2 - L_1}$

RELATIONSHIP BETWEEN TP, AP, MP



SLOPE OF TP CURVE

$MP_L = \frac{\Delta Q}{\Delta L}$

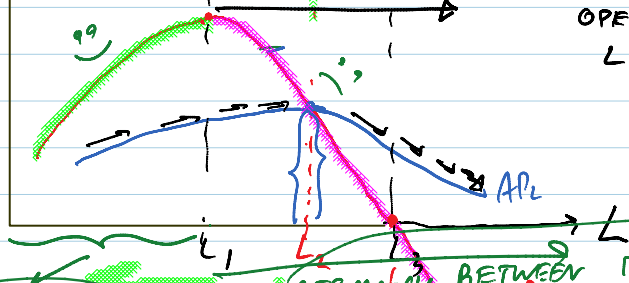
$AP_L = \frac{Q}{L}$

MP > AP

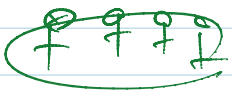
MP = AP

MP < AP

LAW OF DIMINISHING MP STARTS TO OPERATE FROM L_1 ONWARDS.



DIVISION OF LABOUR + SPECIALIZATION



MISMATCH BETWEEN FIXED INPUTS AND VARIABLE INPUTS

MP_L

BEYOND L_3, MP_L BECOMES NEGATIVE, i.e., ADDING MORE LABOUR IS COUNTER-PRODUCTIVE, CAUSING OUTPUT TO FALL.

$AP_{L=L_1} = \frac{Q_1}{L_1}$

$AP_{L=L_3} = \frac{Q_3}{L_3}$

OBSERVATION #1 (ON AP_L ON MP_L)

- AP_L REACHES ITS MAXIMUM AT L_2
- MP_L REACHES ITS MAXIMUM AT L_1
- MP_L CUTS AP_L AT THE TOP OF AP CURVE.

OBSERVATION #2 (ON RELATIONSHIP)

- FROM $L=0$ TO $L=L_2$:

BET. AP AND MP) $MP_L > AP_L$ AND AP_L IS RISING.

- AT $L = L_2$:

  $MP_L = AP_L$ AND AP_L REACHES ITS PEAK.

- FROM $L = L_2$ ONWARDS:

  $MP_L < AP_L$ AND AP_L IS FALLING.

EX1 : N = 50, AVERAGE HEIGHT = 150 CM. (AP)

WHEN MP < AP → AP ↓

SCENARIO 1 N = 50 + DORAEMON (MP 120), NEW AVG. HEIGHT < 150 CM.

WHEN MP > AP → AP ↑

SCENARIO 2 N = 50 + DUTCH GUY 200 CM, NEW AVG. HEIGHT > 150 CM.

EX2: GPA

OBSERVATION #3 "LAW OF DIMINISHING MARGINAL PRODUCT"

WHICH STATES THAT WHEN USING VARIABLE (LABOUR) INPUTS WITH FIXED INPUT (CAPITAL), AS VARIABLE INPUTS RISES, MARGINAL PRODUCT OF VARIABLE INPUTS WOULD EVENTUALLY FALL !!!