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ECON 2316

Lecture 9:
Theory of the Firm

Theory of the firm
- how a firm's costs vary w/ output
- How it makes cost minimizing production decisions

3 steps
- Production technology
- Cost constraints
- Input choices

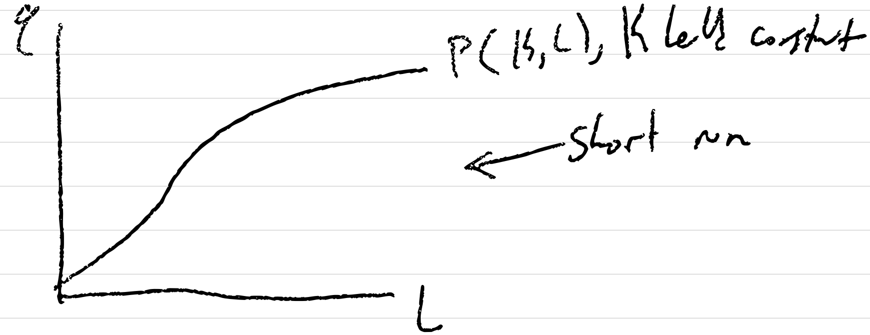
Factors of Production
- 3 generalized factors
  - Raw materials (M)
  - Labor (L)
  - Capital (K), physical and human capital
    - note: human capital represents skills held by workers, not the workers themselves

Production Function
- highest output for every combo of output

$$\boxed{q = f(K, L)}$$

- describe technically feasible
  - what can we produce when the firm uses each combo of K, L as efficiently as possible?

NOT a PPF!



Short Run – at least 1 factor cannot be varied
- Fixed input – cannot vary in the short-run
- Variable input – can vary in the short-run

Long Run – All factors vary

Production w/ one variable input (short-run)
- Marginal products

Average Product
- output per unit of a particular input
- AP_L

$$AP_L = \frac{\text{output}}{\text{quantity of labor}} = \frac{q(K, L)}{L}$$

held constant in S.R.

Example (K held fixed)

$q = K^{0.5}L^{0.5}$, suppose $K = 25$

What is AP_L when $L = 16$? $AP_L = \frac{q}{L} = \frac{20}{16}$

$= \frac{5}{4}$ units/worker

Marginal Product

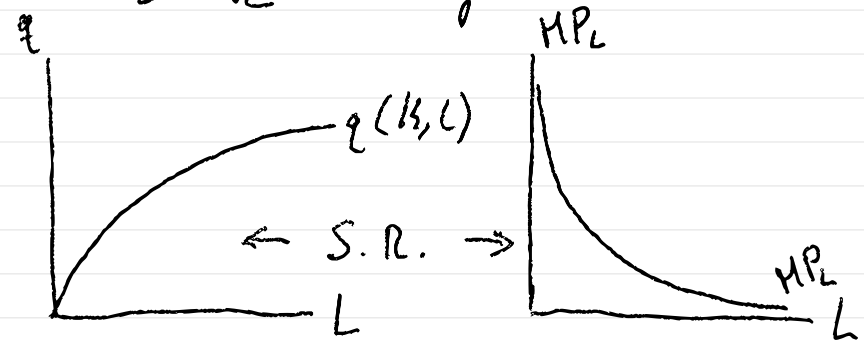
- additional output produced as an input is increased by one unit

$$MP_L = \frac{\Delta q}{\Delta L} \quad \text{(when } K \text{ is const in the S.r)}$$

$$\Rightarrow MP_L = \frac{\partial q}{\partial L} \quad \text{w/ continuous } q(K, L)$$

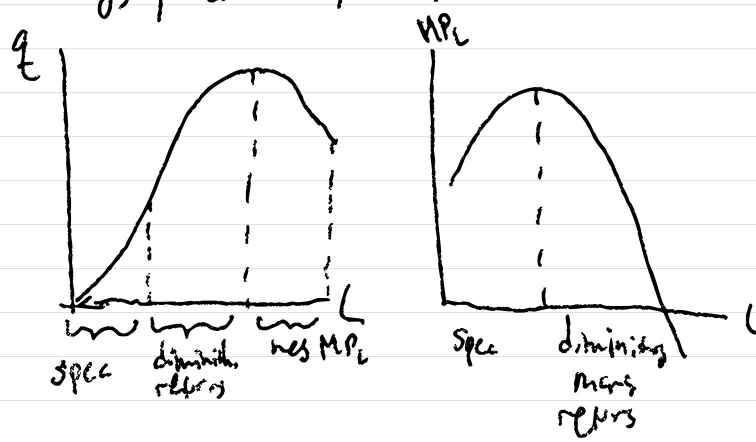
in our previous example ($q = 5L^{0.5}$)

$$\frac{\partial q}{\partial L} = \frac{2.5}{\sqrt{L}} \text{ for any } L$$



Based in particular on the C-D prod. function

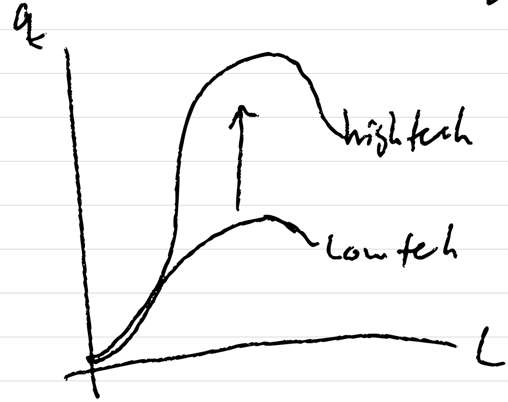
Generally, production functions:



Labor Productivity
- AP_L for an entire industry

General rule
- Labor productivity ↑ as stock of capital grows

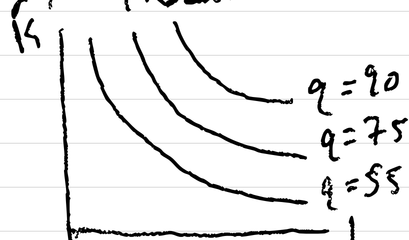
In addition
- Technological change allows factors of production to be used more efficiently



Production w/ 2 inputs (Long run)

Isoquant:
- curve showing combos of inputs produce same level of output

Long Run Production



$$MRTS = \frac{MP_L}{MP_K}$$

↑

Marginal rate of technical substitution

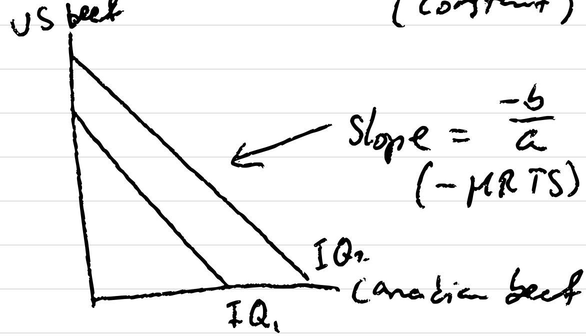
$MP_L = \frac{\partial q}{\partial L}$, $MP_K = \frac{\partial q}{\partial K}$

Cobb-Douglas Production Function

$$q = AK^{\alpha}L^{\beta}, \quad 0<\alpha<1, \; 0<\beta<1$$

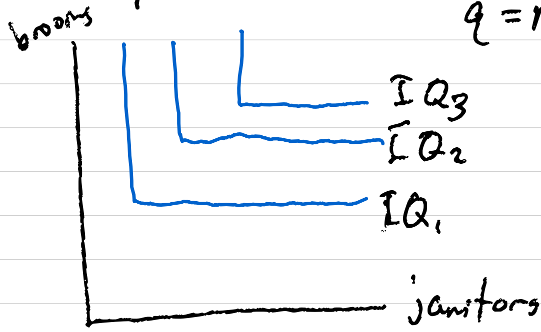
Perfect Substitutes

$$q = aK + bL, \quad MRTS = \frac{b}{a}$$
(constant)



Perfect Complements (Leontif production function)

$$q = \min(aK, bL)$$



Practice:

1) $q(K,L) = K^{0.5}L^{0.5}$, $K = 100$

$= 10L^{0.5}$

a) $100 = 10L^{0.5}$

$L = 100$ units

b) at $100 = K$ and $100 = L$:

$MPL = \frac{\partial q}{\partial L} = \frac{5}{\sqrt{L}} = \frac{1}{2}$

2) $q(K,L)$