PERTEMUAN 6

TEORI DAN ESTIMASI PRODUKSI

POKOK BAHASAN

6.1. Organisasi dan Fungsi Produksi

6.2. FP dengan Satu Input Variabel

6.3. FP dengan Dua Input Variabel

6.4. Skala Hasil (Returns to Scale)

6.5. Fungsi Produksi Empiris

6.6. Inovasi dan Persaingan Global

6.1. Organisasi dan Fungsi Produksi

Organisasi Produksi

- **Input**
  - Tenaga kerja (labor), Modal (capital), Tanah (land)
- **Input Tetap**
- **Input Variabel**
- **Jangka Pendek**
  - Paling tidak satu input tetap
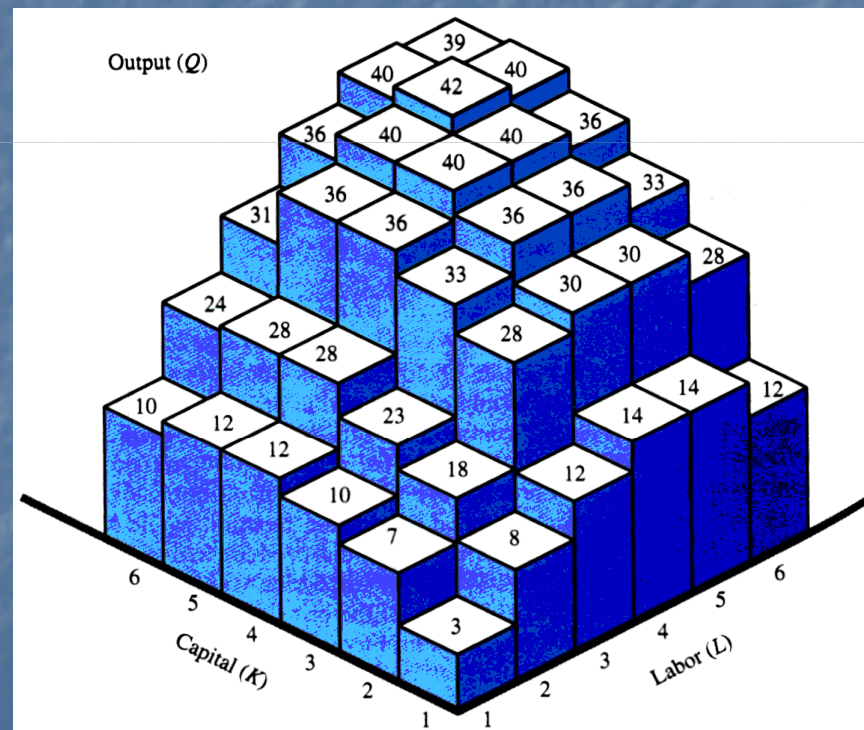- **Jangka Panjang**
  - Semua input variabel

Fungsi Produksi

$$Q = f(L, K)$$

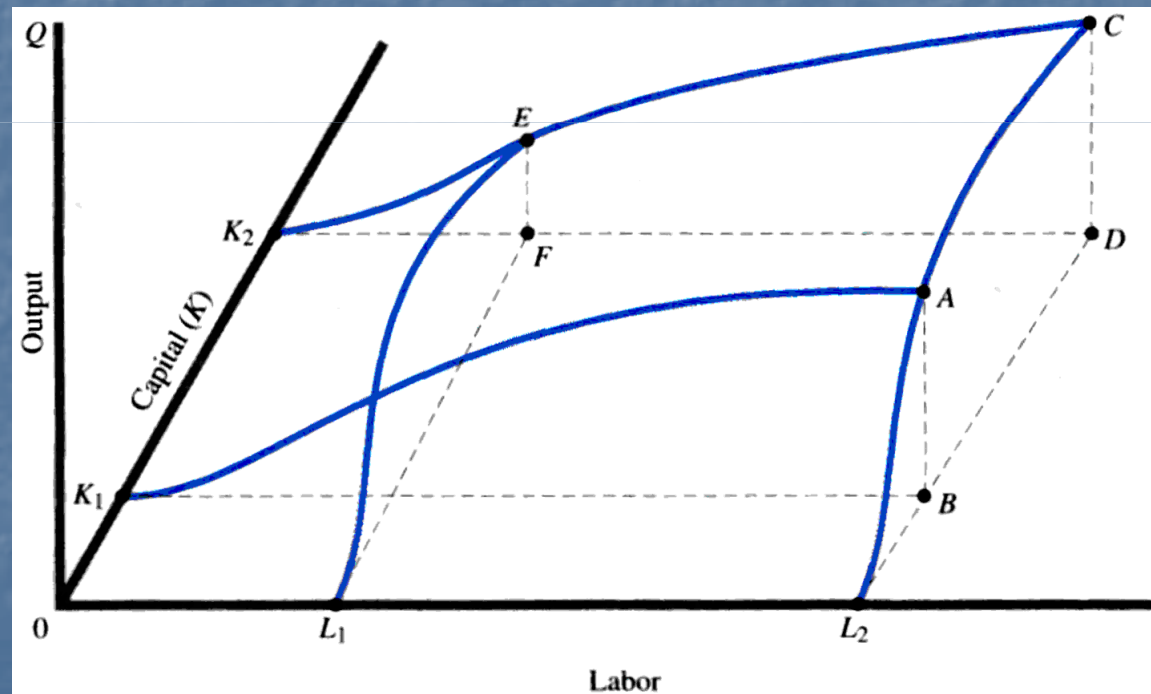| K							Q
6	10	24	31	36	40	39	
5	12	28	36	40	42	40	
4	12	28	36	40	40	36	
3	10	23	33	36	36	33	
2	7	18	28	30	30	28	
1	3	8	12	14	14	12	
	1	2	3	4	5	6	L

Fungsi Produksi

Discrete Production Surface

Fungsi Produksi

Continuous Production Surface

6.2. Fungsi Produksi dengan Satu Input Variabel

Total Product $\quad$ TP = Q = f(L)

Marginal Product $\quad MP_L = \dfrac{\Delta TP}{\Delta L}$

Average Product $\quad AP_L = \dfrac{TP}{L}$

Production or Output Elasticity $\quad E_L = \dfrac{MP_L}{AP_L}$
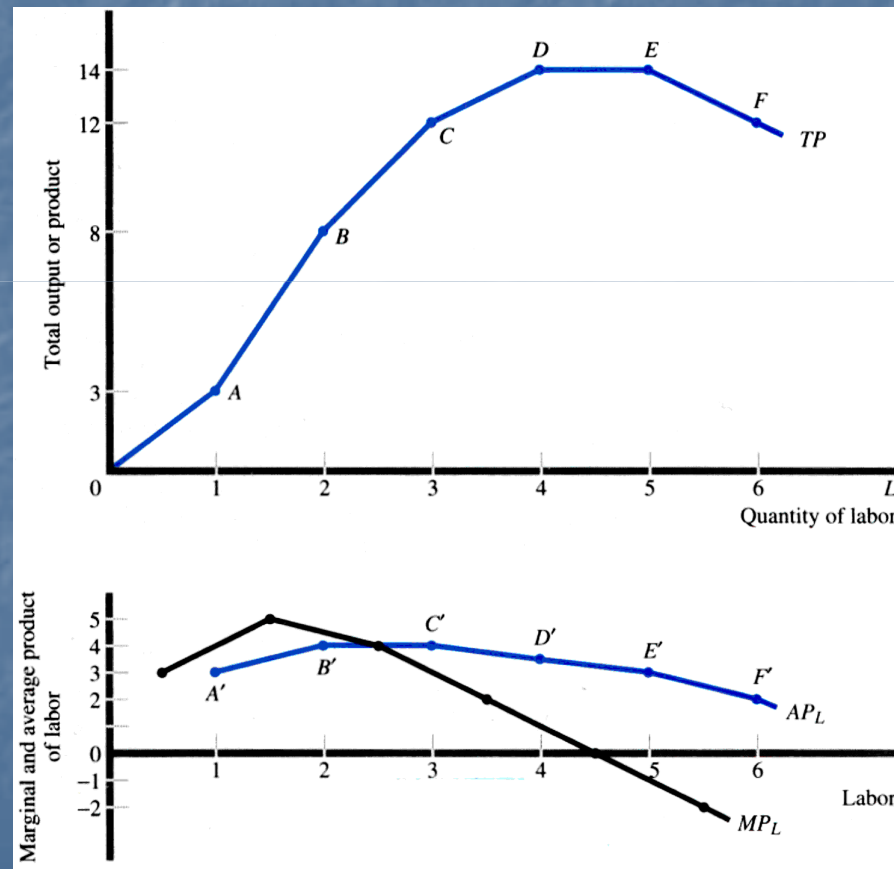
Fungsi Produksi dengan Satu Input Variabel

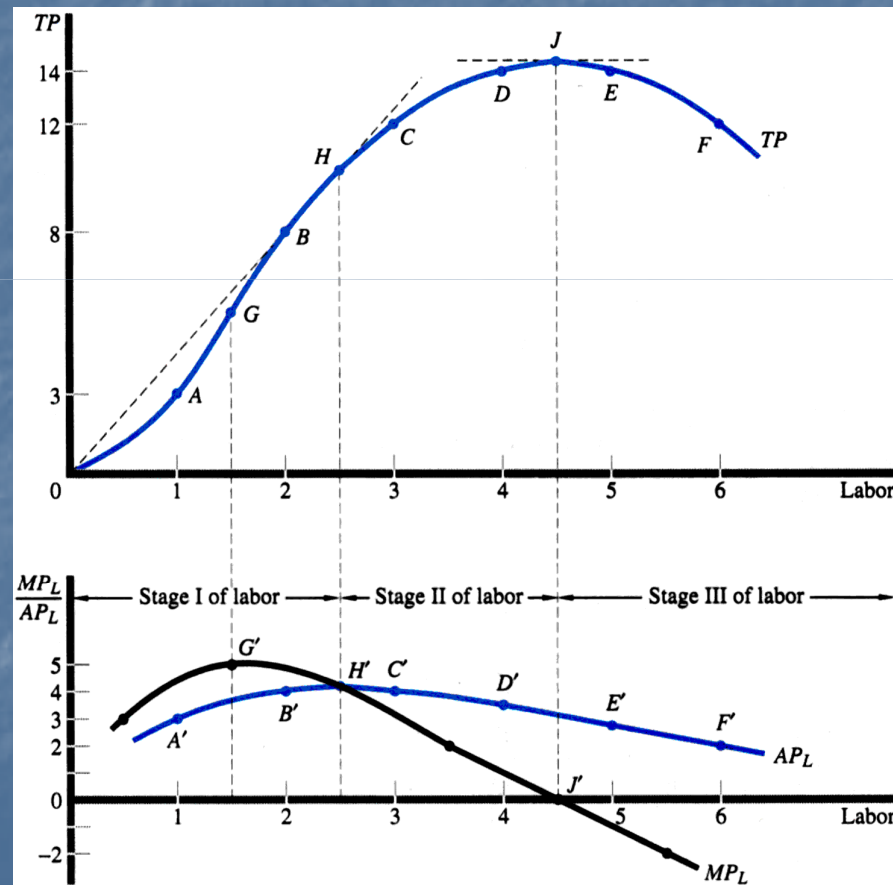Total, Marginal, and Average Product of Labor, and Output Elasticity

L	Q	MP_L	AP_L	E_L
0	0	-	-	-
1	3	3	3	1
2	8	5	4	1.25
3	12	4	4	1
4	14	2	3.5	0.57
5	14	0	2.8	0
6	12	-2	2	-1

Fungsi Produksi dengan Satu Input Variabel

Fungsi Produksi dengan Satu Input Variabel

Penggunaan Input Variabel yang Optimal

Marginal Revenue Product of Labor

$$MRP_L = (MP_L)(MR)$$

Marginal Resource Cost of Labor

$$MRC_L = \frac{\Delta TC}{\Delta L}$$
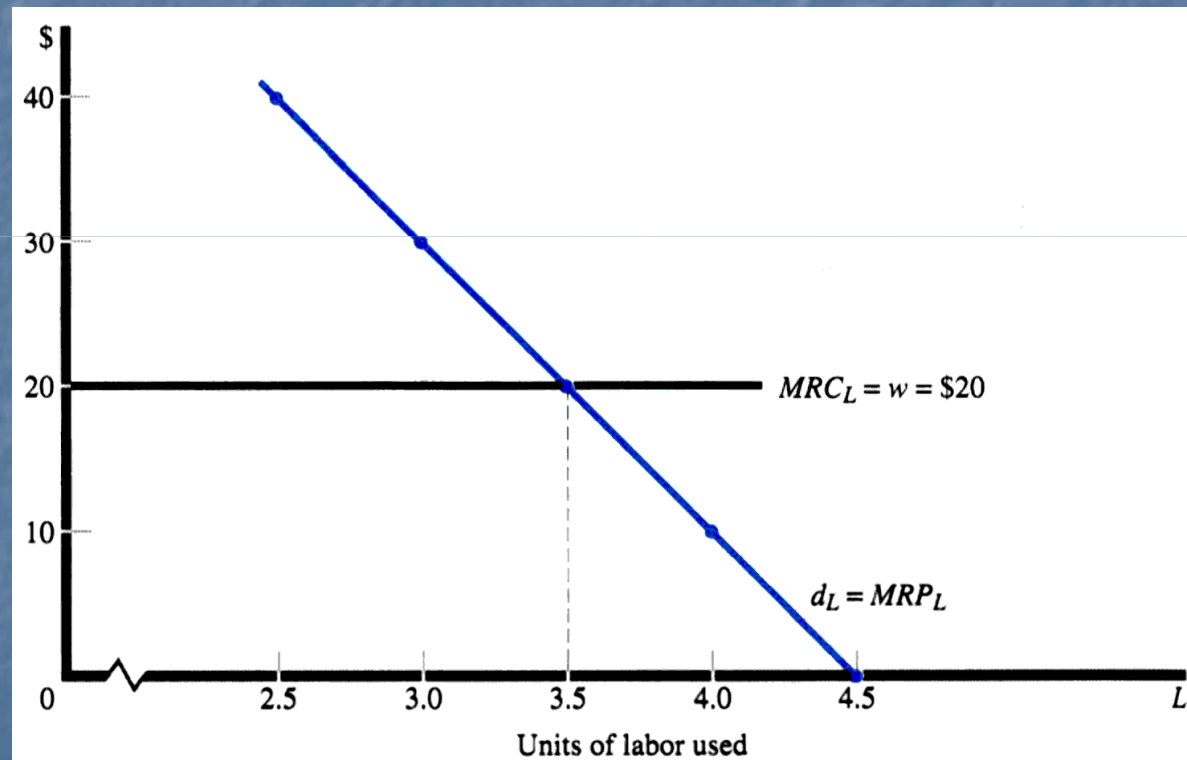
Optimal Use of Labor

$$MRP_L = MRC_L$$

Penggunaan Input Variabel yang Optimal

Use of Labor is Optimal When L = 3.50

| L	MP_L	MR = P	MRP_L	MRC_L
2.50	4	$10	$40	$20
3.00	3	10	30	20
3.50	2	10	20	20
4.00	1	10	10	20
4.50	0	10	0	20

Penggunaan Input Variabel yang Optimal

6.3. Fungsi Produksi dengan Dua Input Variabel

Isoquant = Berbagai kombinasi dari dua input yang dapat menghasilkan tingkat output yang sama.

Perusahaan hanya akan menggunakan kombinasi yang terdapat dalam daerah produksi yang ekonomis, yaitu pada bagian isoquant yang berlereng negatif.
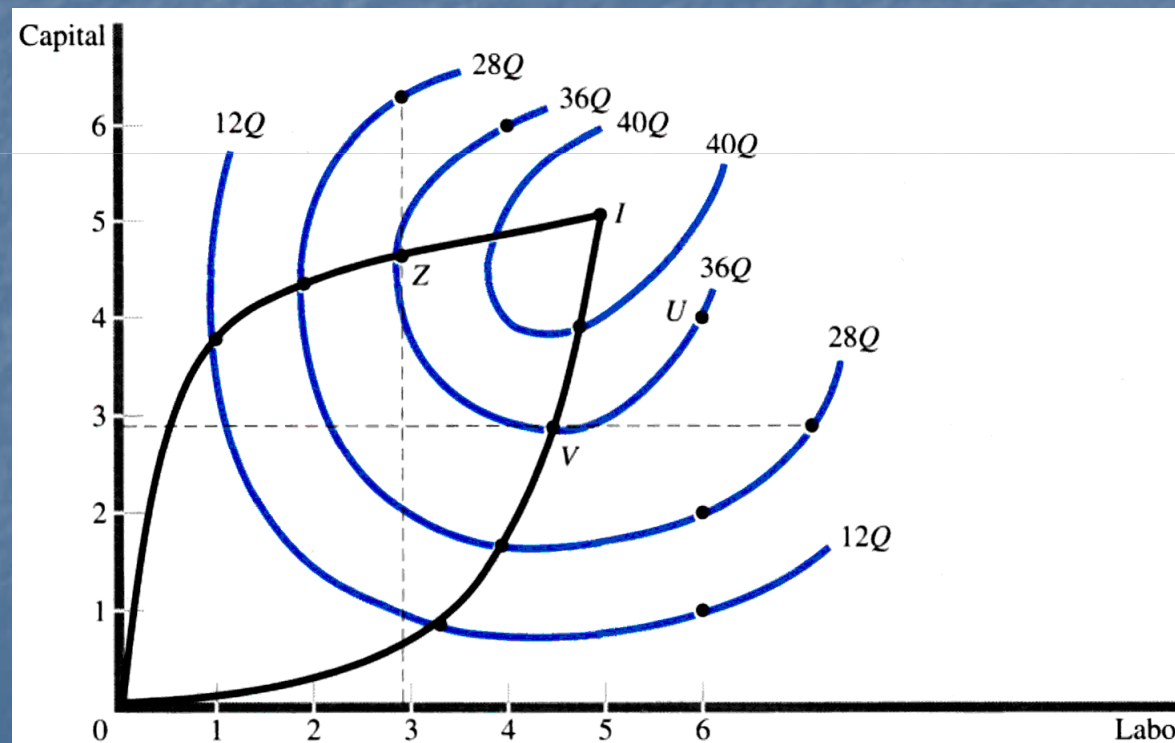
Fungsi Produksi dengan Dua Input Variabel

Isoquant
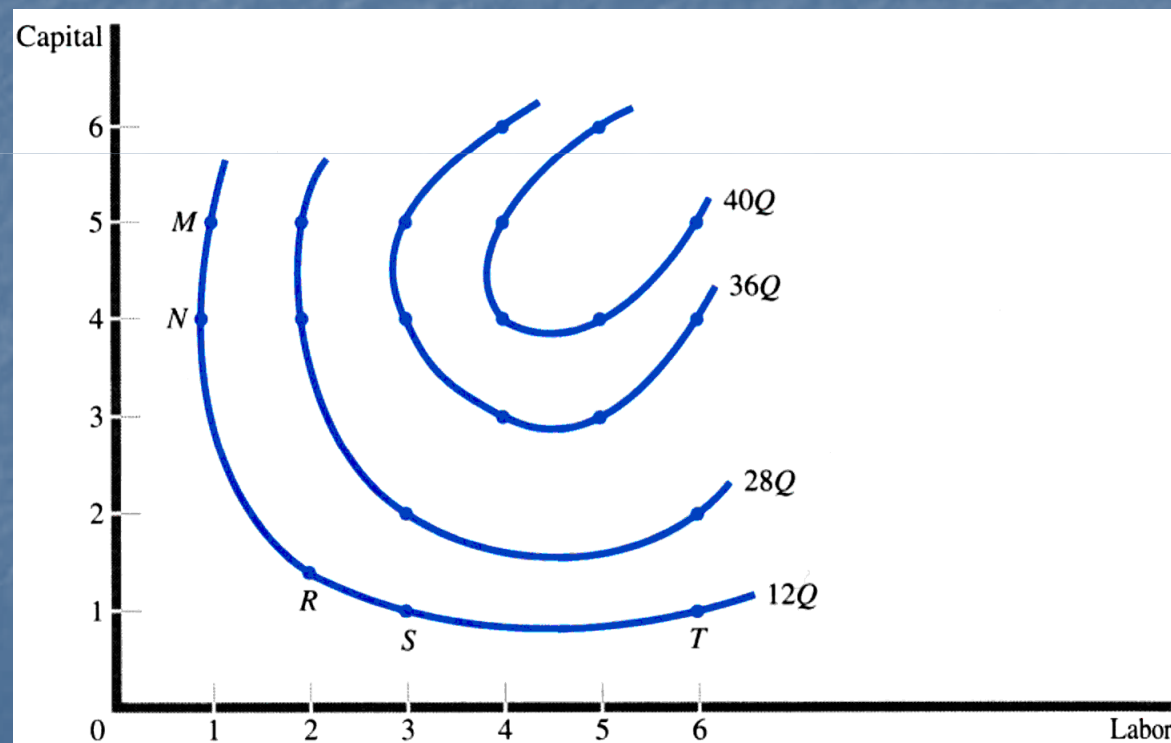
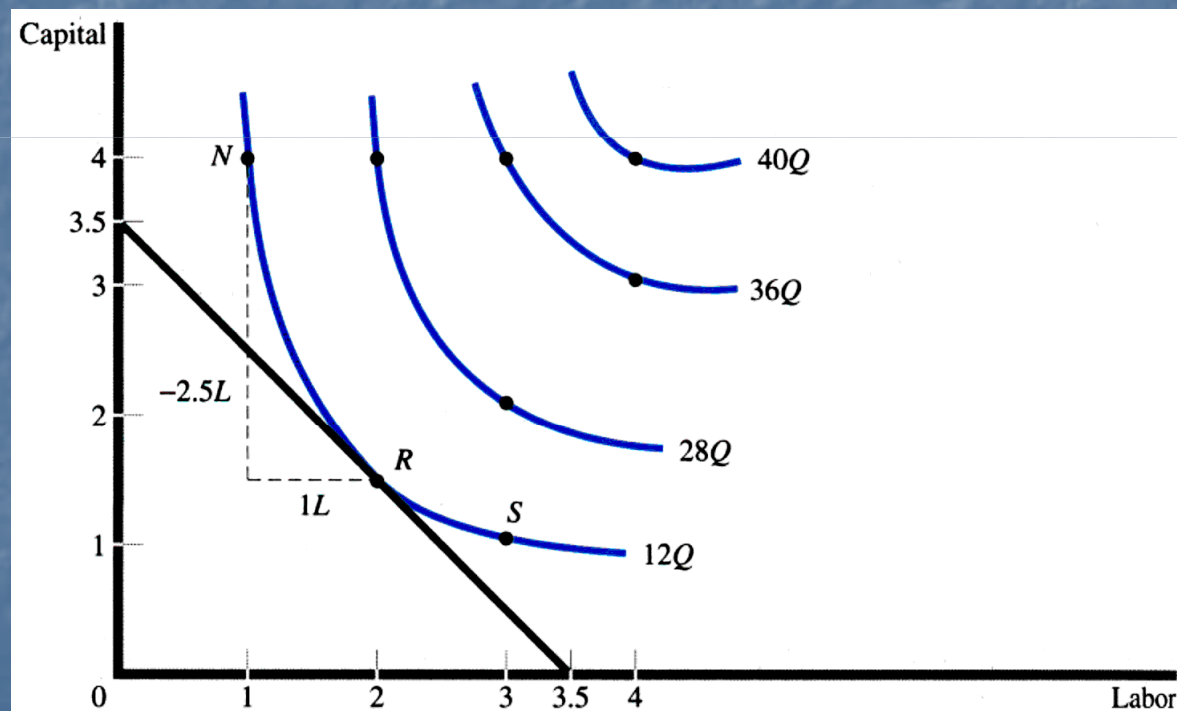# Fungsi Produksi dengan Dua Input Variabel

Daerah Produksi yang Ekonomis

Fungsi Produksi dengan Dua Input Variabel

Marginal Rate of Technical Substitution

$$MRTS = -\Delta K/\Delta L = MP_L/MP_K$$
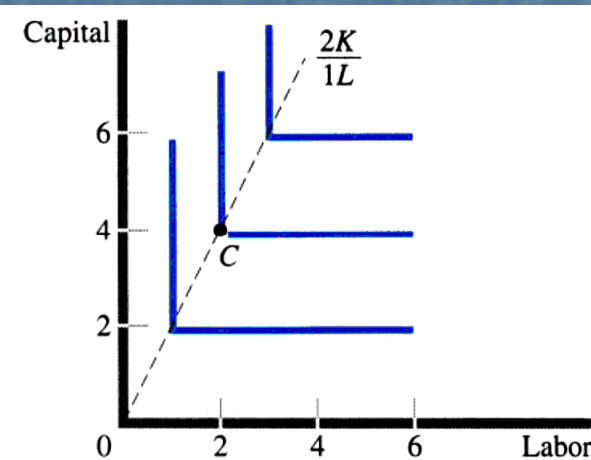
Fungsi Produksi dengan Dua Input Variabel

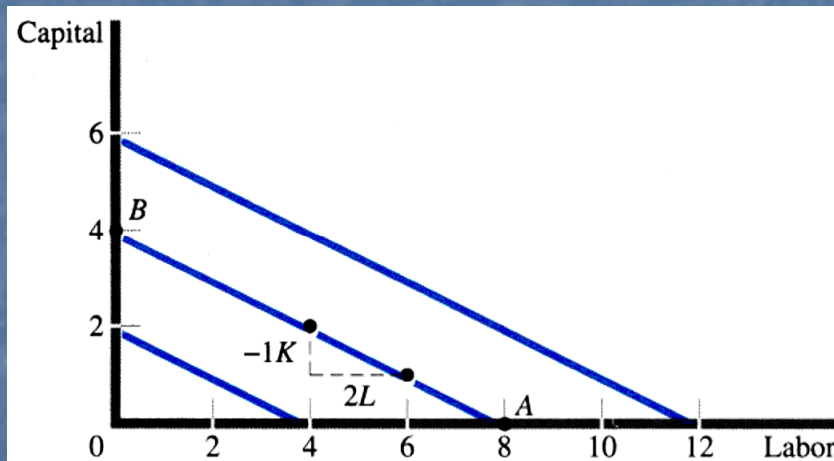## MRTS = -(-2.5/1) = 2.5

Fungsi Produksi dengan Dua Input Variabel

Substitusi Sempurna   Pelengkap Sempurna

Kombinasi Input yang Optimal

Isocost = Berbagai kombinasi dari dua input yang dapat dibeli perusahaan dengan biaya total yang sama.

$$C = wL + rK$$

$$C = Total\ Cost$$

$$w = Wage\ Rate\ of\ Labor\ (L)$$

$$K = \frac{C}{r} - \frac{w}{r}L$$

$$r = Cost\ of\ Capital\ (K)$$

Kombinasi Input yang Optimal

Isocost
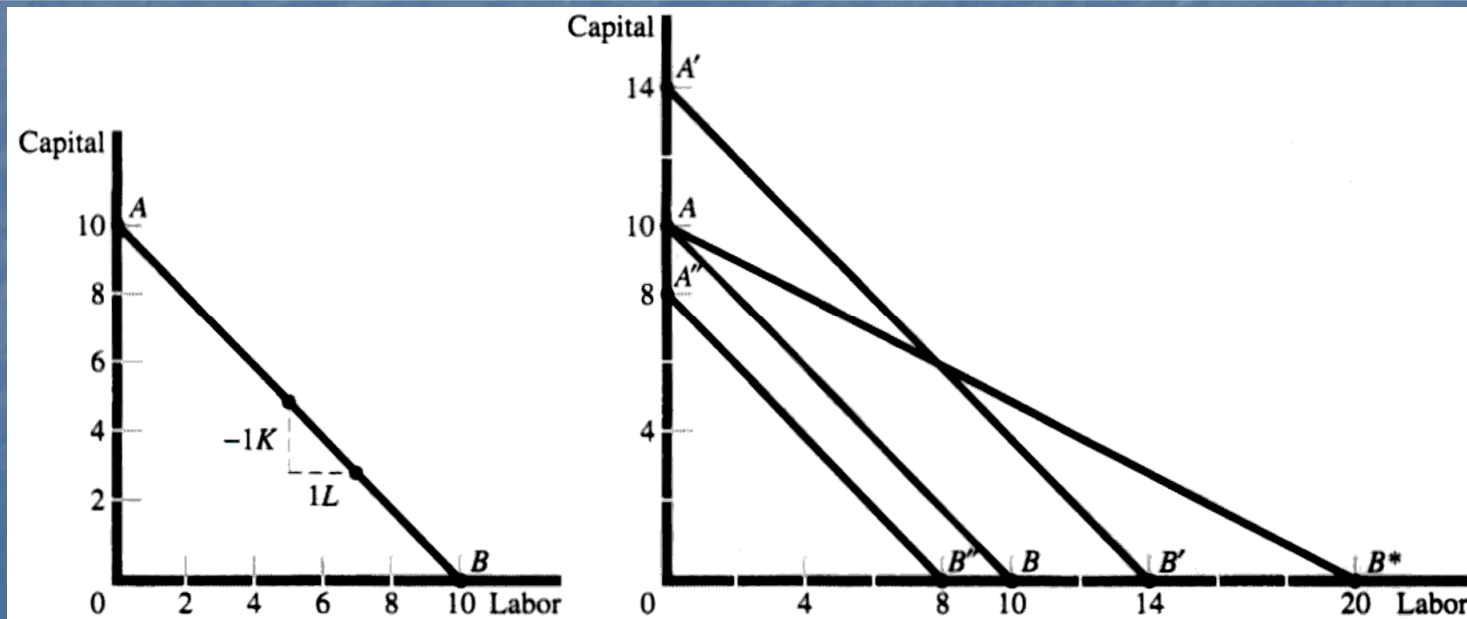
AB   C = $100, w = r = $10

A'B'   C = $140, w = r = $10

A"B"   C = $80, w = r = $10

AB*   C = $100, w = $5, r = $10

Kombinasi Input yang Optimal

MRTS = w/r
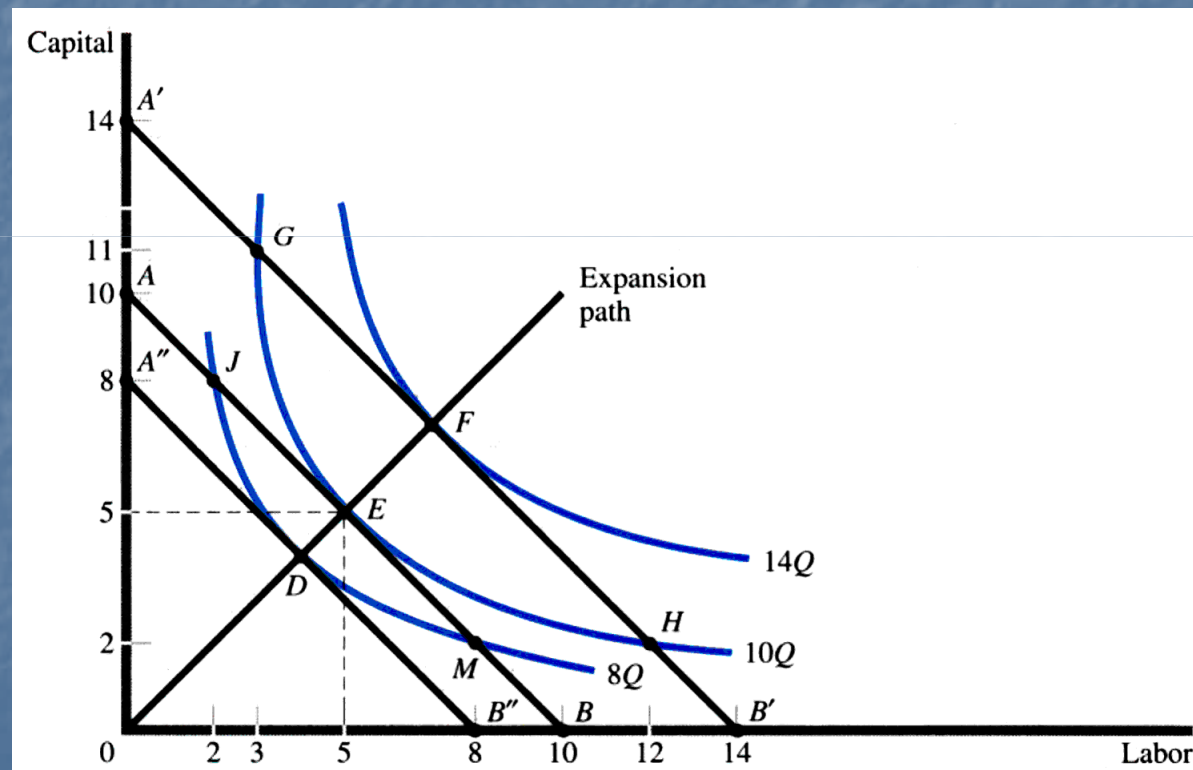
Kombinasi Input yang Optimal

Pengaruh Perubahan Harga Input
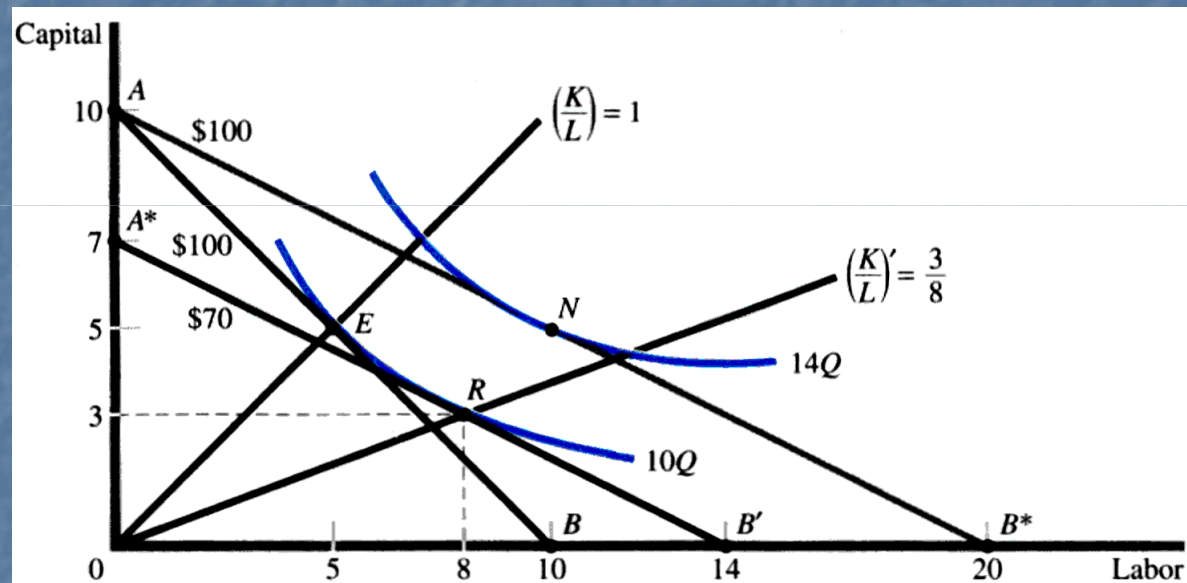
6.4. Skala Hasil

Fungsi Produksi: $Q = f(L, K)$

$\lambda Q = f(hL, hK)$

Jika $\lambda = h \rightarrow$ f memiliki skala hasil yang tetap (constant returns to scale).

Jika $\lambda > h \rightarrow$ f memiliki skala hasil yang meningkat (increasing returns to scale).

Jika $\lambda < h \rightarrow$ f memiliki skala hasil yang menurun (decreasing returns to scale).

Skala Hasil
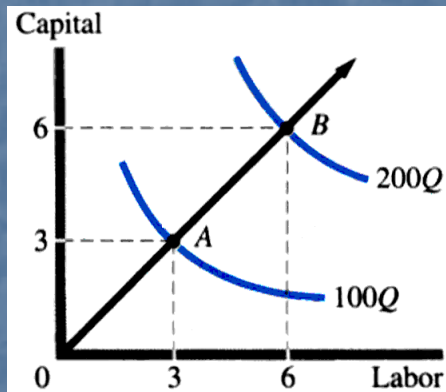
Constant Returns to Scale	Increasing Returns to Scale	Decreasing Returns to Scale
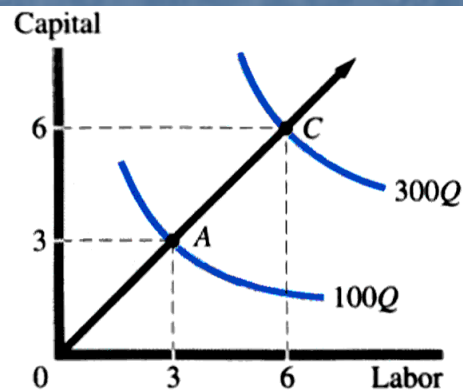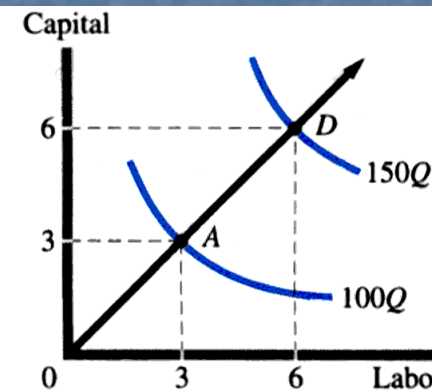
6.5. Fungsi Produksi Empiris

Fungsi Produksi Cobb-Douglas

$$Q = AK^a L^b$$

Dalam bentuk Logaritma Almiah

$$\ln Q = \ln A + a \ln K + b \ln L$$

6.6. Inovasi dan Persaingan Global

- Product Innovation
- Process Innovation
- Product Cycle Model
- Just-In-Time Production System
- Competitive Benchmarking
- Computer-Aided Design (CAD)
- Computer-Aided Manufacturing (CAM)

LATIHAN 6

1. The table below presents estimates of the maximum levels of output possible with various combinations of two inputs.

Capital (K)

5	11	25	37	47	51
4	10	23	33	41	44
3	8	18	25	30	34
2	5	11	16	20	22
1	1	4	8	10	11
	1	**2**	**3**	**4**	**5**

Labor (L)

Assume that a unit of output sells for $2 and that the firm currently employs two units of capital (K = 2).

(i)   What is the marginal product of labor when L = 4?

(ii)   What is the average product of labor when L = 4?

(iii)   What is the marginal revenue product of labor when L = 4? What is the output elasticity of labor when L = 4?

(iv)   If the wage rate of labor is $10, how many units of labor should the firm hire and how many units of output should it produce?

2. The table below presents estimates of the maximum levels of output possible with various combinations of two inputs.

Capital (K)

5	11	25	37	47	51
4	10	23	33	41	44
3	8	18	25	30	34
2	5	11	16	20	22
1	1	4	8	10	11
	1	**2**	**3**	**4**	**5**

Labor (L)

Assume that a unit of output sells for $3 and that the firm currently employs three units of capital (K = 3).

(i)   What is the marginal product of labor when L = 4?

(ii)   What is the average product of labor when L = 4?

(iii) What is the marginal revenue product of labor when L = 4? What is the output elasticity of labor when L = 4?

(iv)   If the wage rate of labor is $12, how many units of labor should the firm hire and how many units of output should it produce?

3. The table below presents estimates of the maximum levels of output possible with various combinations of two inputs.

Capital (K)

5	11	25	37	47	51
4	10	23	33	41	44
3	8	18	25	30	34
2	5	11	16	20	22
1	1	4	8	10	11
	1	**2**	**3**	**4**	**5**

Labor (L)

Assume that a unit of output sells for $5 and that the firm currently employs one unit of capital (K = 1).

(i) What is the marginal product of labor when L = 2?

(ii) What is the average product of labor when L = 2?

(iii) What is the marginal revenue product of labor when L = 2? What is the output elasticity of labor when L = 2?

(iv) If the wage rate of labor is $10, how many units of labor should the firm hire and how many units of output should it produce?

4. The table below presents estimates of the maximum levels of output possible with various combinations of two inputs.

Capital (K)

5	11	25	37	47	51
4	10	23	33	41	44
3	8	18	25	30	34
2	5	11	16	20	22
1	1	4	8	10	11
	1	**2**	**3**	**4**	**5**

Labor (L)

Assume that a unit of output sells for $10 and that the firm currently employs four units of capital (K = 4).

(i) What is the marginal product of labor when L = 5?

(ii) What is the average product of labor when L = 5?

(iii) What is the marginal revenue product of labor when L = 5? What is the output elasticity of labor when L = 5?

(iv) If the wage rate of labor is $80, how many units of labor should the firm hire and how many units of output should it produce?

5. A firm currently employs 40 production workers and 5 supervisors. The marginal product of the last production worker employed is 36 units of output per hour and production workers are paid $8 per hour. The marginal product of the last supervisor employed is 120 units of output per hour and supervisors are paid $20 per hour. Every employee works 40 hours per week.

(i) What is the firm's total labor cost per week?

(ii) Assume that hours of labor by supervisors (Ls) is plotted on the vertical axis and hours of labor by production workers (Lp) is plotted on the horizontal axis. What is the equation for the firm's isocost line? What are the two intercepts of the isocost line?

(iii) Assume that the firm's isoquants are smooth curves and that labor hours can be varied continuously. Is the firm producing the maximum level of output given its current level of cost? If it is, explain how you can tell. If it isn't, explain what it should do to increase output.

6. A firm currently employs 25 production workers and 4 supervisors. The marginal product of the last production worker employed is 50 units of output per hour and production workers are paid $10 per hour. The marginal product of the last supervisor employed is 160 units of output per hour and supervisors are paid $40 per hour. Every employee works 40 hours per week.

(i) What is the firm's total labor cost per week?

(ii) Assume that hours of labor by supervisors (L_s) is plotted on the vertical axis and hours of labor by production workers (L_p) is plotted on the horizontal axis. What is the equation for the firm's isocost line? What are the two intercepts of the isocost line?

(iii) Assume that the firm's isoquants are smooth curves and that labor hours can be varied continuously. Is the firm producing the maximum level of output given its current level of cost? If it is, explain how you can tell. If it isn't, explain what it should do to increase output.

7. A firm currently employs 45 production workers and 6 supervisors. The marginal product of the last production worker employed is 50 units of output per hour and production workers are paid $10 per hour. The marginal product of the last supervisor employed is 150 units of output per hour and supervisors are paid $30 per hour. Every employee works 40 hours per week.

(i) What is the firm's total labor cost per week?

(ii) Assume that hours of labor by supervisors (L_s) is plotted on the vertical axis and hours of labor by production workers (L_p) is plotted on the horizontal axis. What is the equation for the firm's isocost line? What are the two intercepts of the isocost line?

(iii) Assume that the firm's isoquants are smooth curves and that labor hours can be varied continuously. Is the firm producing the maximum level of output given its current level of cost? If it is, explain how you can tell. If it isn't, explain what it should do to increase output.

8. A firm wants to minimize the cost of producing 2,800 units of output per week. It has hired a production engineer to identify alternative production technologies that will accomplish this goal. The production technologies use the different combinations of capital (K) and labor (L) that are listed below.

K	100	90	80	70	60	50	40	30	20	10	8	7
L	8	9	11	14	18	23	30	40	55	80	90	100

Assume that the rental price of capital is $5 and the wage rate of labor is $4. Determine the minimum cost of producing 2,800 units of output and then show how the combination of inputs that yield the minimum cost can be determined using the marginal approach.