Macroeconomic Theory and Policy

Lecture 13

Human Capital and Economic Growth

Limitations of the Solow Model

Higher saving rate does not lead to higher growth rate

(because of diminishing marginal productivity of capital)

$$g_y = \frac{\Delta y}{y} = a + \alpha g_k + (1-\alpha) g_n$$

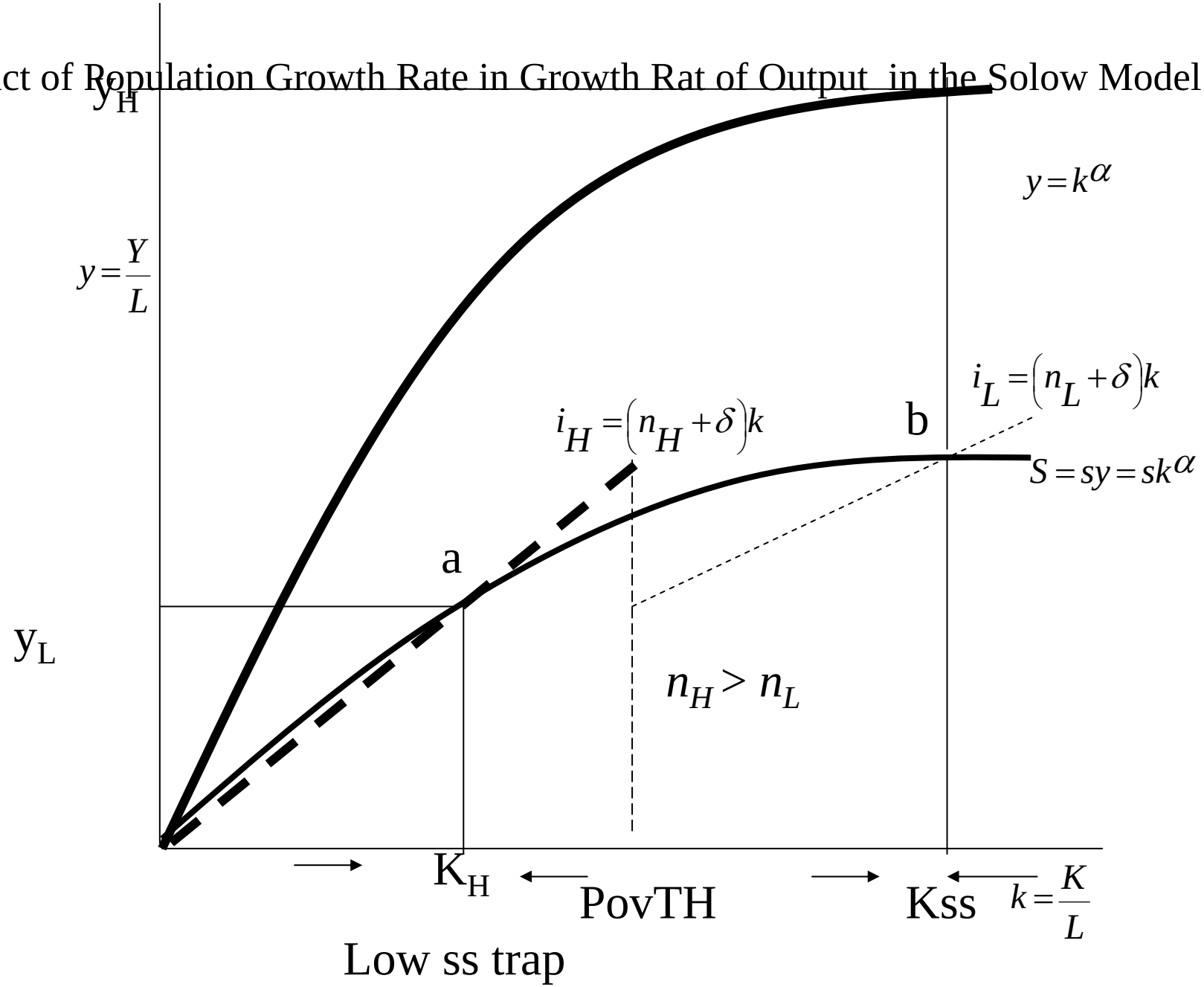
⇨ $g_y - g_n = \frac{a}{(1-\alpha)}$

⇨ does not explain technological growth, it is exogenous.

Total multi-factor productivity or Solow residual

$$a = g_y - \alpha g_k - (1-\alpha) g_n$$

Impact of Population Growth Rate in Growth Rat of Output in the Solow Model



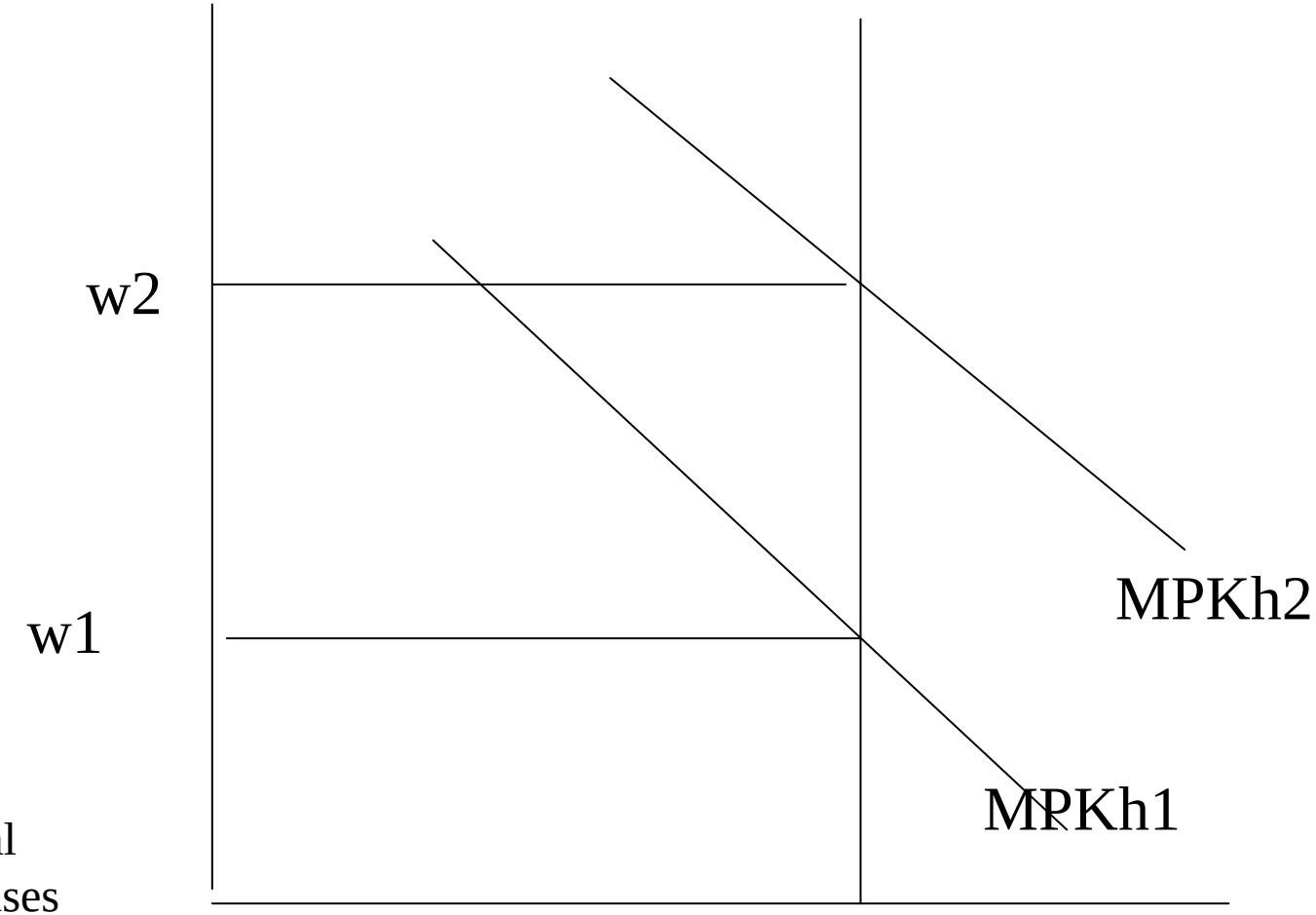
General Indicators of human capital

- Education:literacy, numeracy and problem solving ability
- Sound health and long life expectancy
- Productive skills
- Proportion of Independent Thinkers in the population
- Opportunities for on the job training

How Human Capital Contributes to the Economic Growth?

Thinking➔	New Ideas	←Formula ←Design ←Software
Action➔	Better Tools	Machines Consultancy
Application➔	More and High Quality Products	←Cars Computers Planes Medicine Trains etc.

Increase in Real Wage Rate with Human Capital



Technological advancement raises wage rate but reduces Work hours.

Complimentarily Between Physical and Human Capital

Solow model with human capital (H):

$$Y = AK^{\alpha} L^{\beta} H^{\gamma}$$

Marginal product of human capital:

$$MPH = \gamma AK^{\alpha} L^{\beta} H^{\gamma-1} = \gamma Y / H$$

Marginal product of physical capital:

$$MPK = \alpha AK^{\alpha-1} L^{\beta} H^{\gamma} = \alpha Y / K$$

If the Human capital is proportion of physical capital:

$$H = \psi K \text{ and } \gamma + \alpha = 1$$

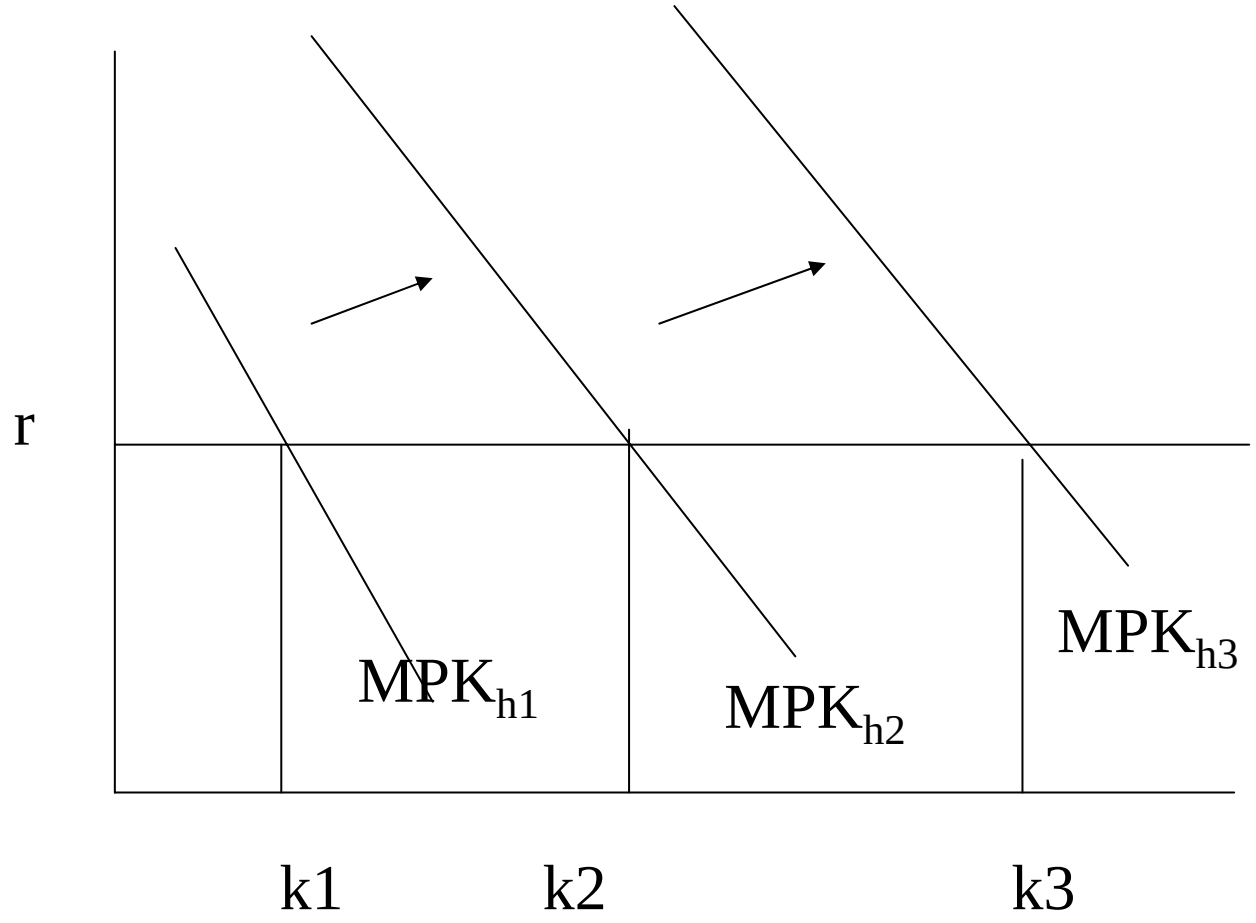
$$Y = AK^{\alpha} L^{\beta} = A(\psi)^{\gamma} K^{\alpha+\gamma} L^{\beta} \text{ .or } Y = A(\psi)^{\gamma} KL^{\beta} .$$

Constant Marginal product of capital:

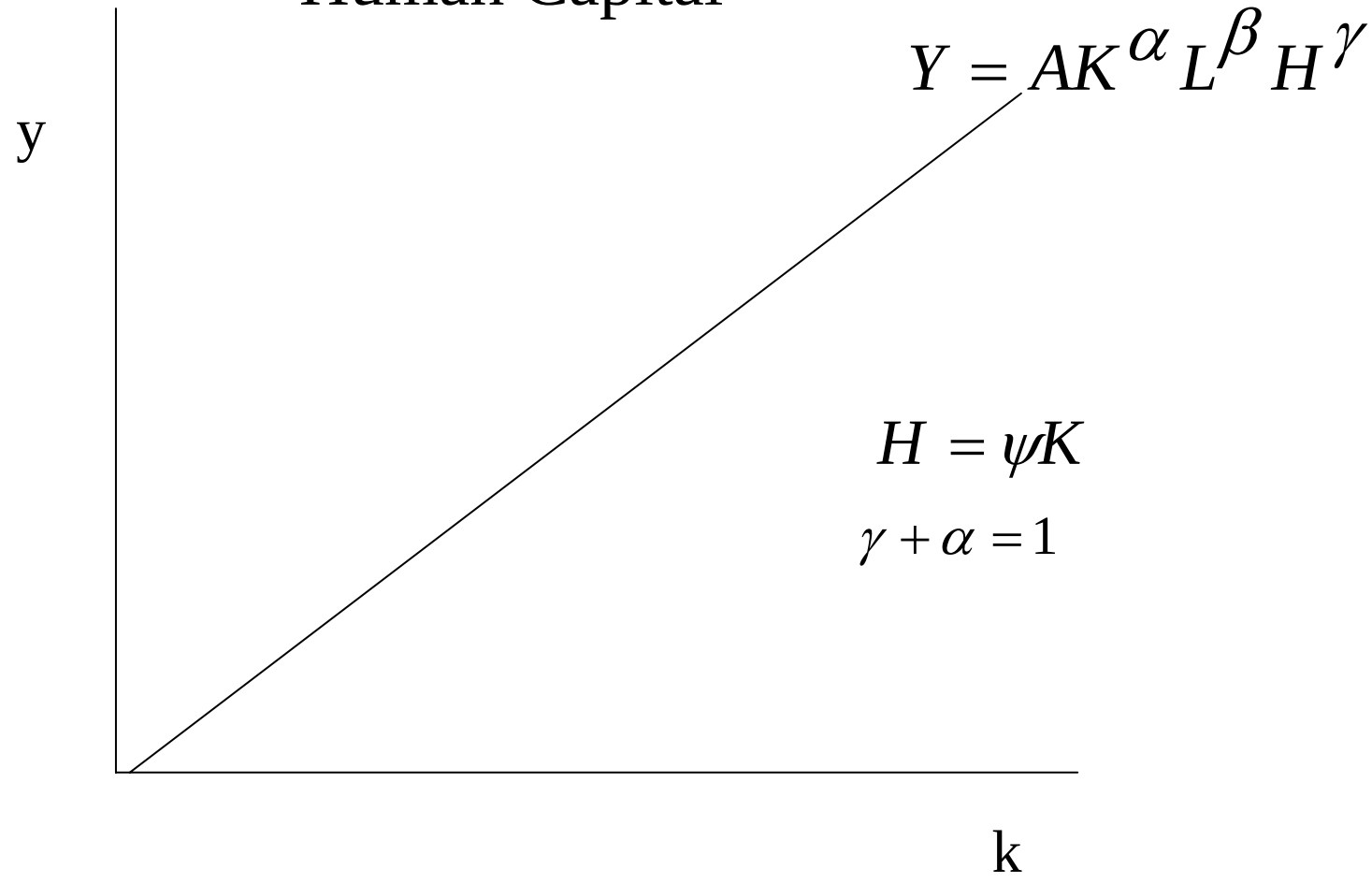
$$MPK = \frac{\partial Y}{\partial K} = A(\psi)^{\gamma} L^{\beta}$$

More saving ➔ More Capital ➔ Steadily Rising Output

Constant Marginal Product of Capital with Human Capital



Saving, Capital Accumulation and Output with Human Capital



Higher Economic Growth Rate with More saving with Human Capital

- $g_y - g_n = 0 \;\; g_y = g_n$,
- or $k = \frac{K}{L}$ ➔ $\frac{dk}{k} = \frac{dK}{K} - \frac{dL}{L} = 0 \;\; g_k - g_n = 0 \;\; g_k = g_n$.

Recall that $\alpha + \beta + \gamma = 1$

$$\frac{\Delta y}{y} = g_y = g_a + \alpha g_k + (1 - \alpha - \gamma) g_n + \gamma g_h$$

$$g_y - g_n = g_a + \alpha \left(g_k - g_n \right) + \gamma \left(g_h - g_n \right)$$

$$\left(g_y - g_n \right) - \gamma \left(g_h - g_n \right) = g_a + \alpha \left(g_k - g_n \right)$$

Per capita growth rate adjusted for human capital this depends on technological growth rate as well as per capita growth rate of capital stock.

Lucas Model of Human Capital and Growth

Production function

$$Y = K^{\alpha}\left(\theta h L\right)^{1-\alpha}$$

h = is human capital per worker

θ = fraction of time spent on working

L = labour supply –(assume this as given)

Example :

If K=100, L=100 h=3 θ=0.8, α =0.3

$$Y = 100^{0.3}\left(0.8*3*100\right)^{0.7} = 100(2.4)^{0.7}$$

= 185 where with $Y = K^{\alpha}L^{1-\alpha}$ =100.

Production Function with Study Time and Capital

Define output and capital stock per effective labour as:

$$k = \frac{K}{hL} \quad y = \frac{Y}{hL}$$

Here hL total amount of effective work hours adjusted for human capital.

Output per effective worker y depends on capital per effective worker k and time spent on studying which can be derived as

$$\frac{Y}{hL} = \frac{K^{\alpha}(\theta hL)^{1-\alpha}}{hL}$$

$$y = \theta^{1-\alpha} k^{\alpha}$$

Study Time and Growth of Human Capital

Human capital grows faster when people spend more time in studying

$$\dot{h} = \phi(1-\theta)h \text{ or } g_h = \frac{\dot{h}}{h} = \phi(1-\theta)$$

where ϕ is the rate of creation of human capital per unit of time spent on studying and (1-θ) is the fraction of time spent on studying.

Stock of human capital for a given time

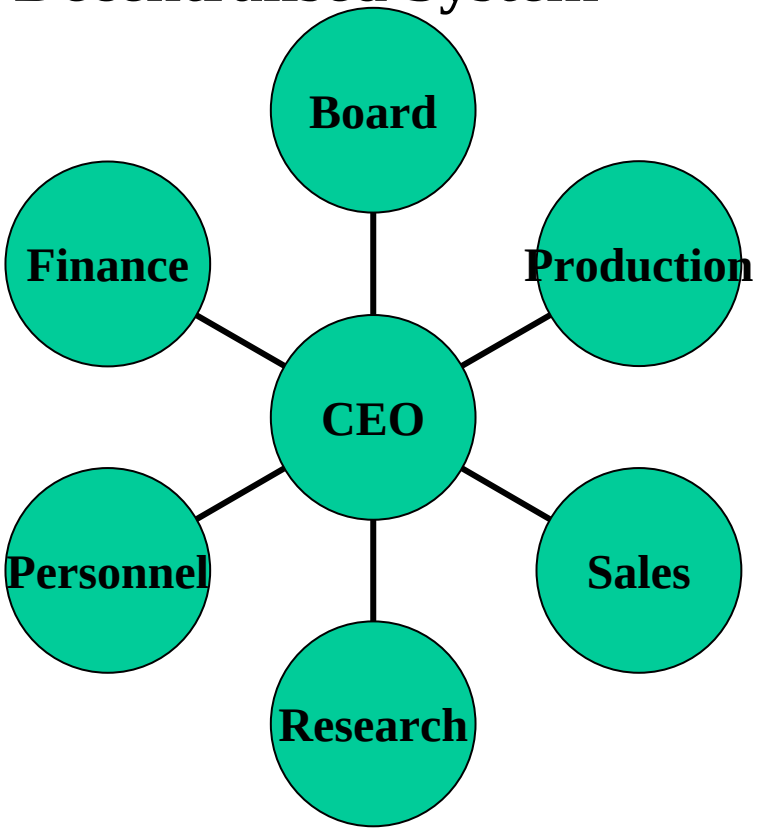
$$h_t = h_0 e^{\phi(1-\theta)t}$$

if h0 =1, ϕ=0.4, (1-θ)=0.2, time (t)=20

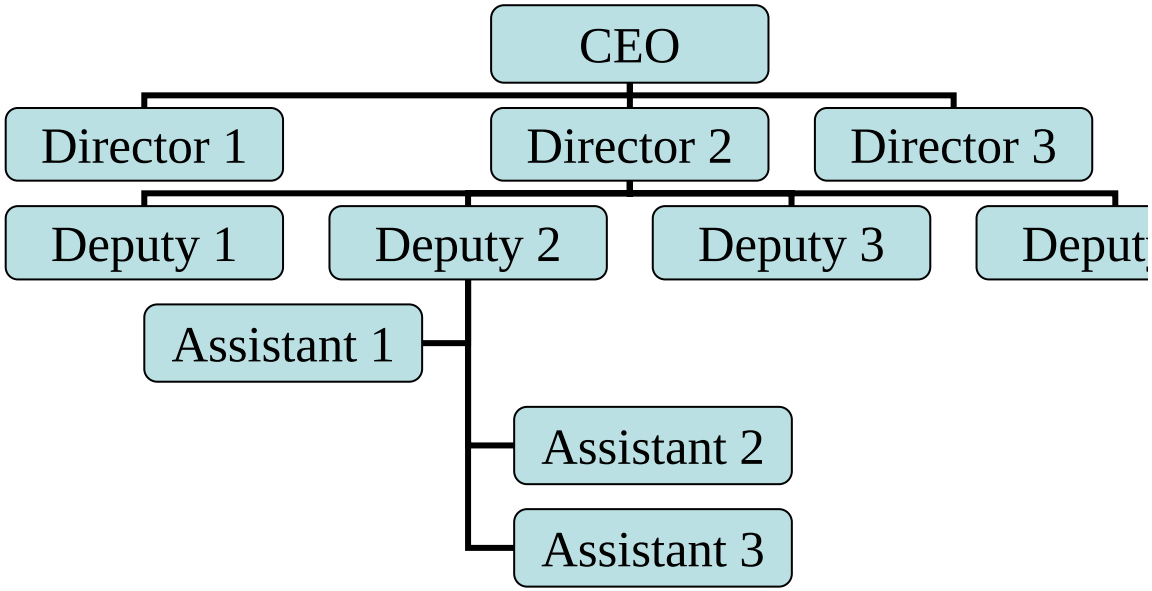
$$h_t = 1.e^{0.4(0.2)20} = 4.95$$

Human Capital in a Production Firm

Decentralised System



Centralised System



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