

DEMAND FOR HEALTH CAPITAL

EE 474 Health Economics

Semester 2/2021

Topics

- The Demand for Health
- Labor–Leisure Trade-Offs
- The Investment/Consumption Aspects of Health
- Investment over Time
- The Demand for Health Capital
- Changes in Equilibrium: Age, Wage, and Education

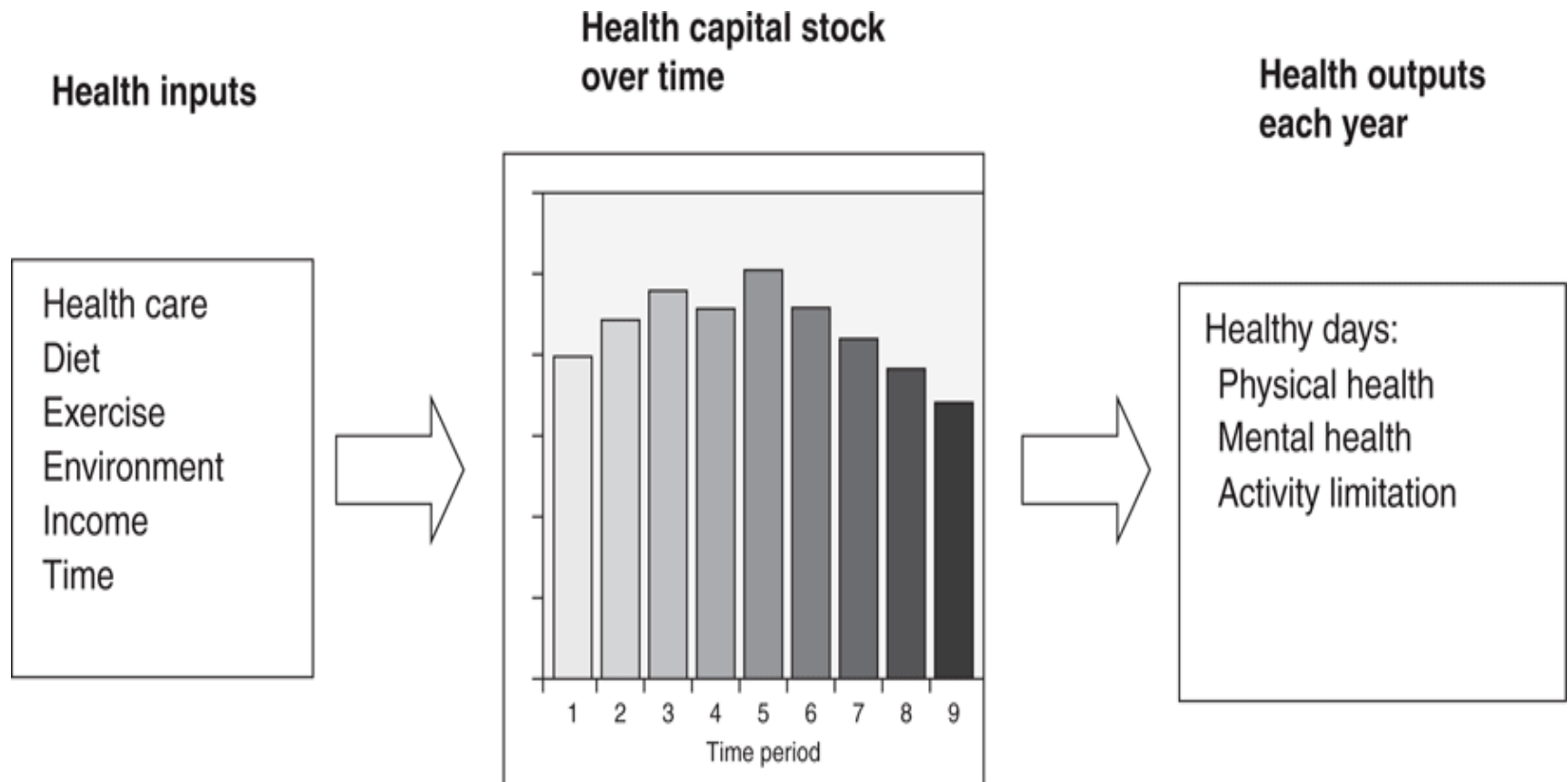
The Demand for Health

- It is not medical care as such that consumers want, but rather health.
 - People demand medical care inputs to produce health.
- Consumers *cannot* simply purchase health from the market.
 - Instead, consumers are *health producers* (by using their own health-improving efforts in combination with purchased medical inputs).
- Health can be thought of as a *capital good*; it lasts for more than one period and depreciates over time.

The Demand for Health

- Health can be treated both as a *consumption good* and an *investment good*.
- As a **consumption good**, health is desired because:
 - It makes people *feel better*;
 - It makes people *live longer*.
- As an **investment good**, health is desired because:
 - It *increases the number of healthy days* available to work and to earn income;
 - It *increases the productivity* when working and increase the earning for each working hour.

A Schematic



A Model for Time Spent Producing Health

- Production of health (*I* = investment in health):

$$I = I(M, T_H)$$

where M = medical care, T_H = time used in producing health

- Production of other goods:

$$B = B(X, T_B)$$

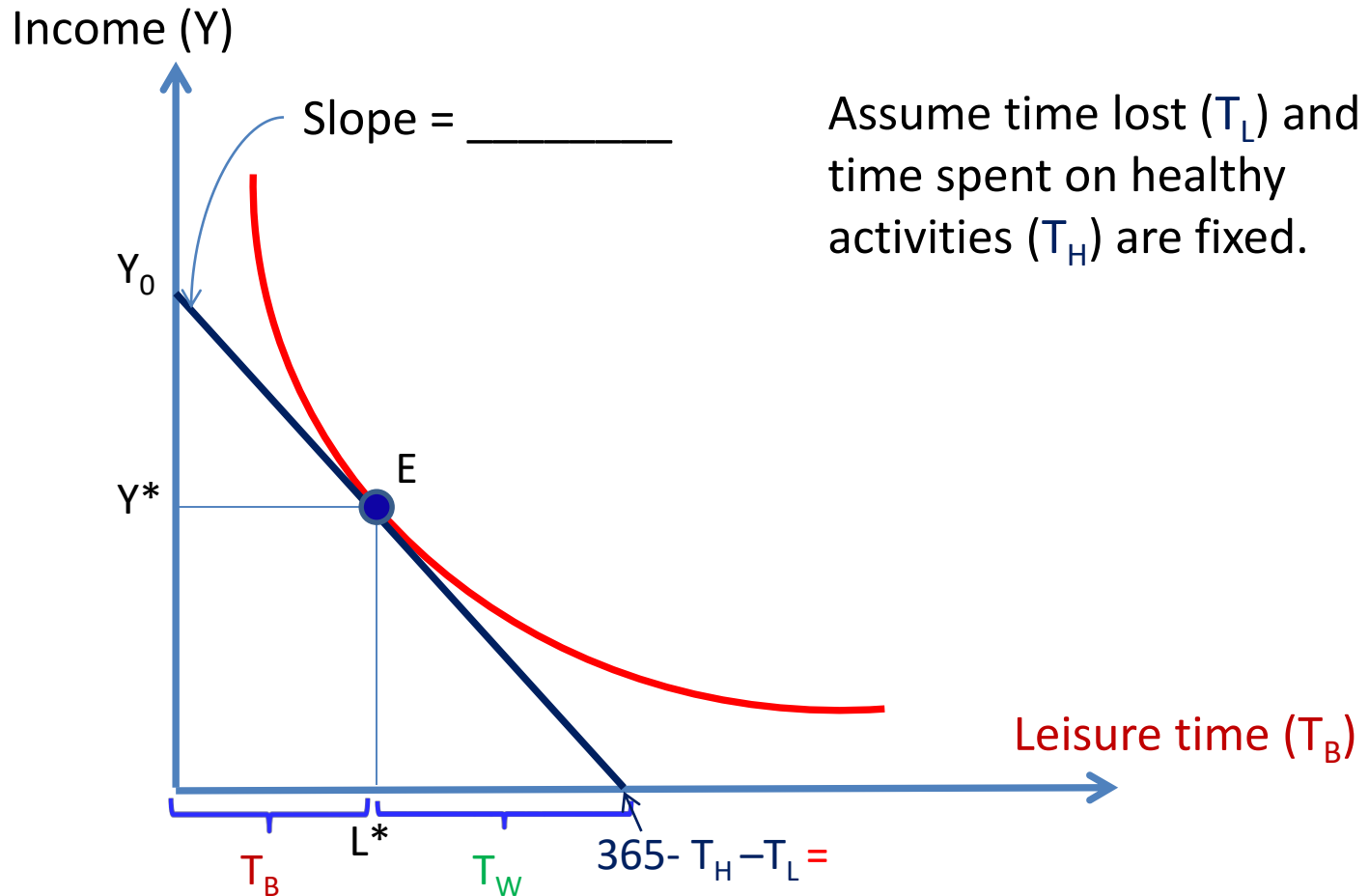
where X = purchased goods, T_B = time used producing other goods

- Total available time:

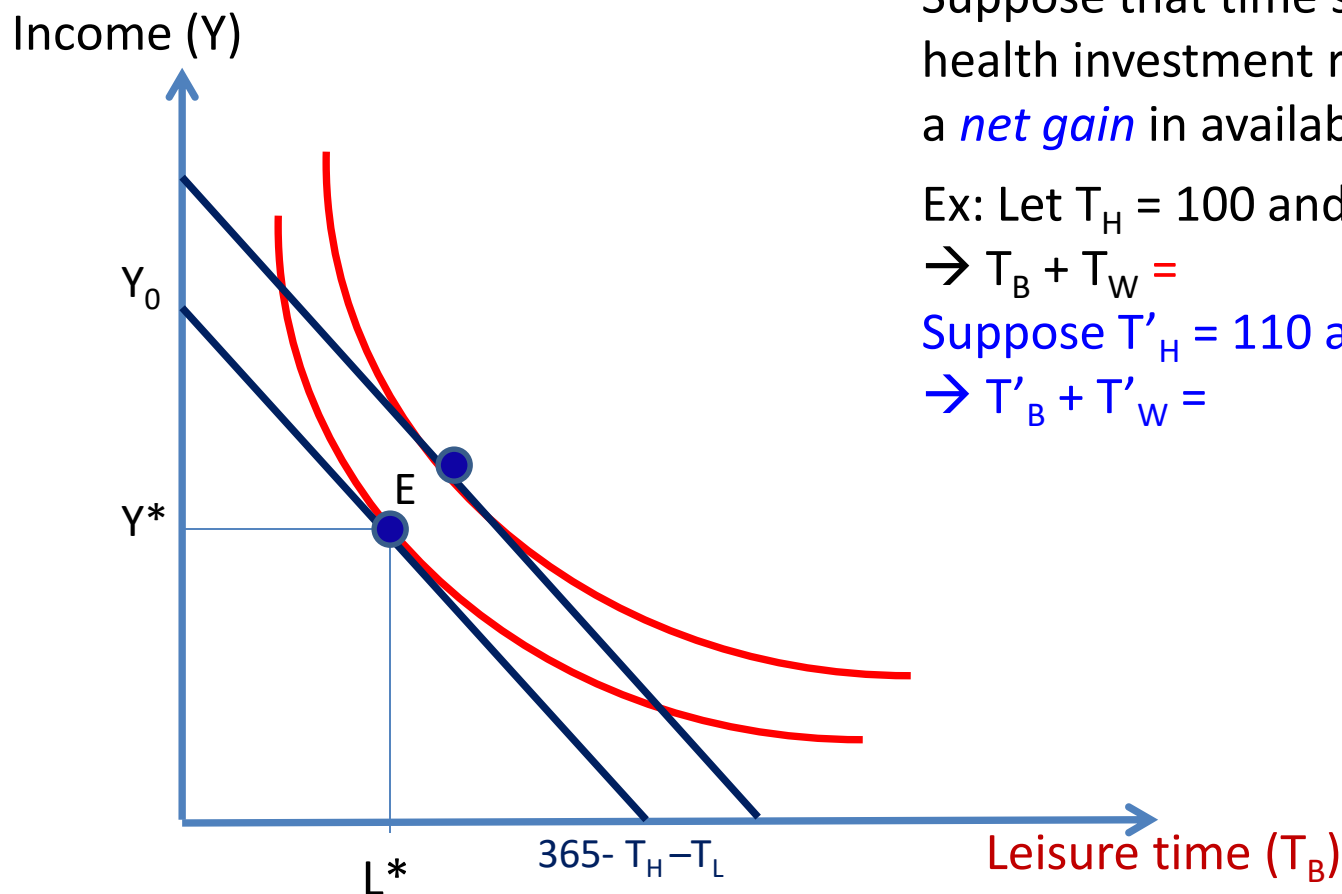
$$T = 365 = T_H + T_B + T_L + T_W$$

where $T_H \rightarrow$ improving health, $T_B \rightarrow$ producing other goods, $T_L \rightarrow$ lost to illness, and $T_W \rightarrow$ working

Labor-Leisure Trade-offs



Impact of Investments in Health



Suppose that time spent on health investment results in a *net gain* in available time.

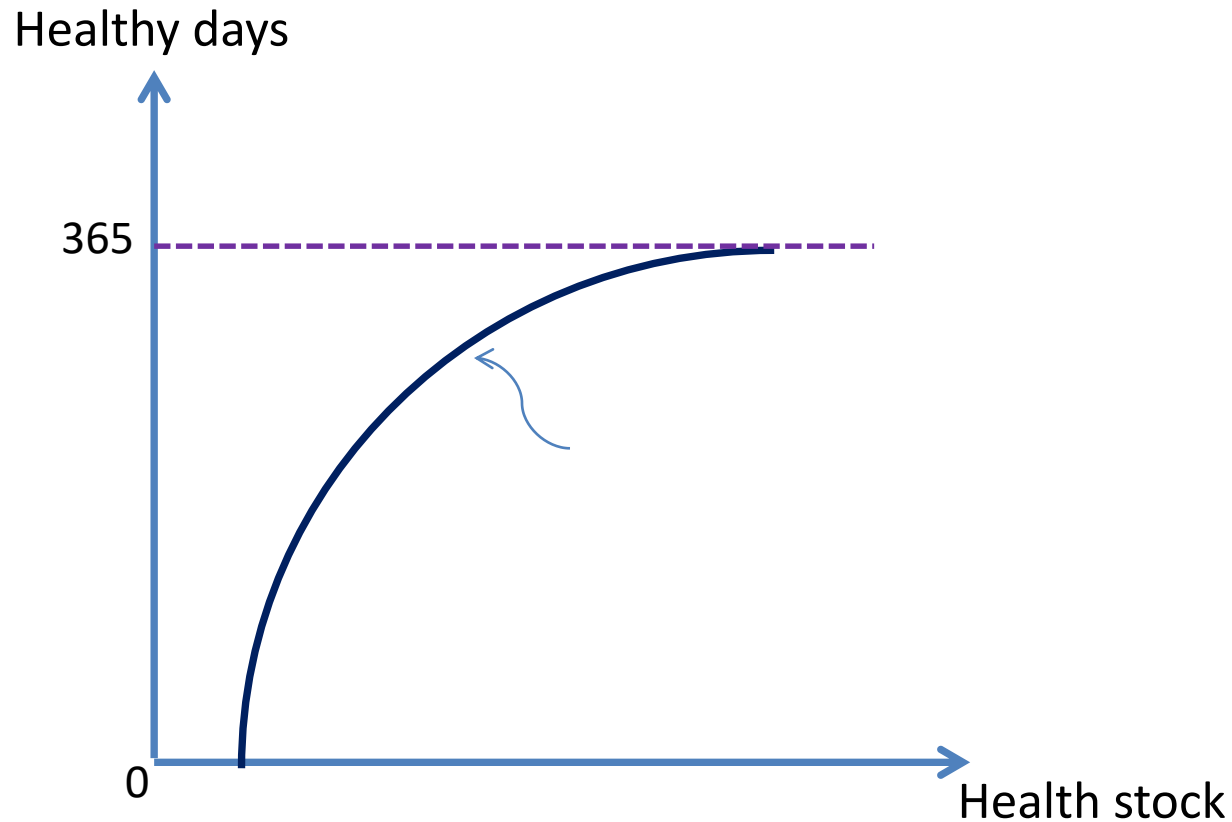
Ex: Let $T_H = 100$ and $T_L = 20$

$\rightarrow T_B + T_W =$

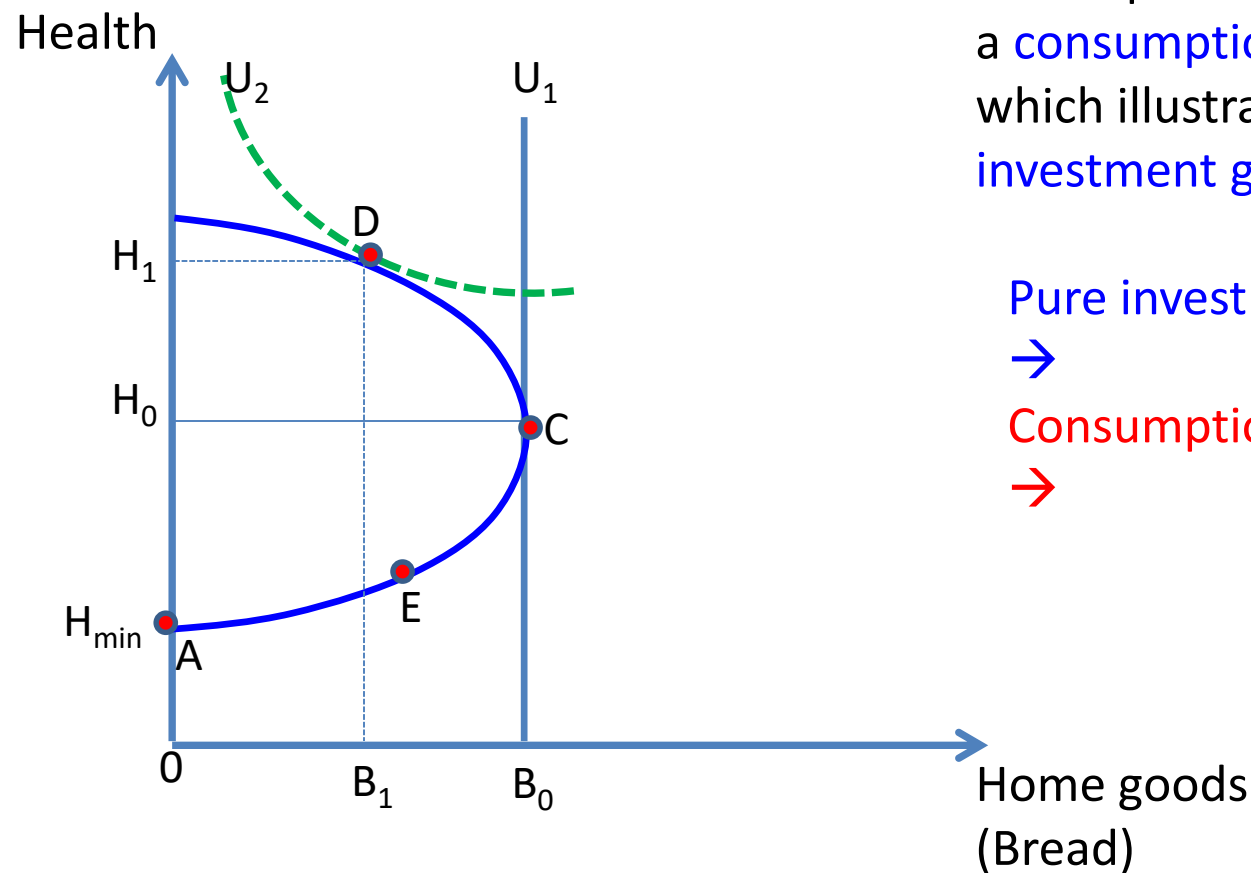
Suppose $T'_H = 110$ and $T'_L = 5$

$\rightarrow T'_B + T'_W =$

Production of Healthy Days



Investment/Consumption Aspects of Health: Production of Home and Health Goods



Which part illustrates health as a **consumption good**, and which illustrates health as an **investment good**?

Pure investment model



Consumption-investment model



Investment in Health Over Time

- Think of health as a *capital*. So what does it *cost* to invest in **health capital**?
- Use an analogy of an investment in an X-ray machine:
 - **Costs**
 - **Future earnings → expected returns**
 - **Depreciation**
- Example: Suppose an X-ray machine costs \$100,000, and the interest rate is 5% per year.
 - How much revenue should we receive from the use of this X-ray machine to make it a good investment?

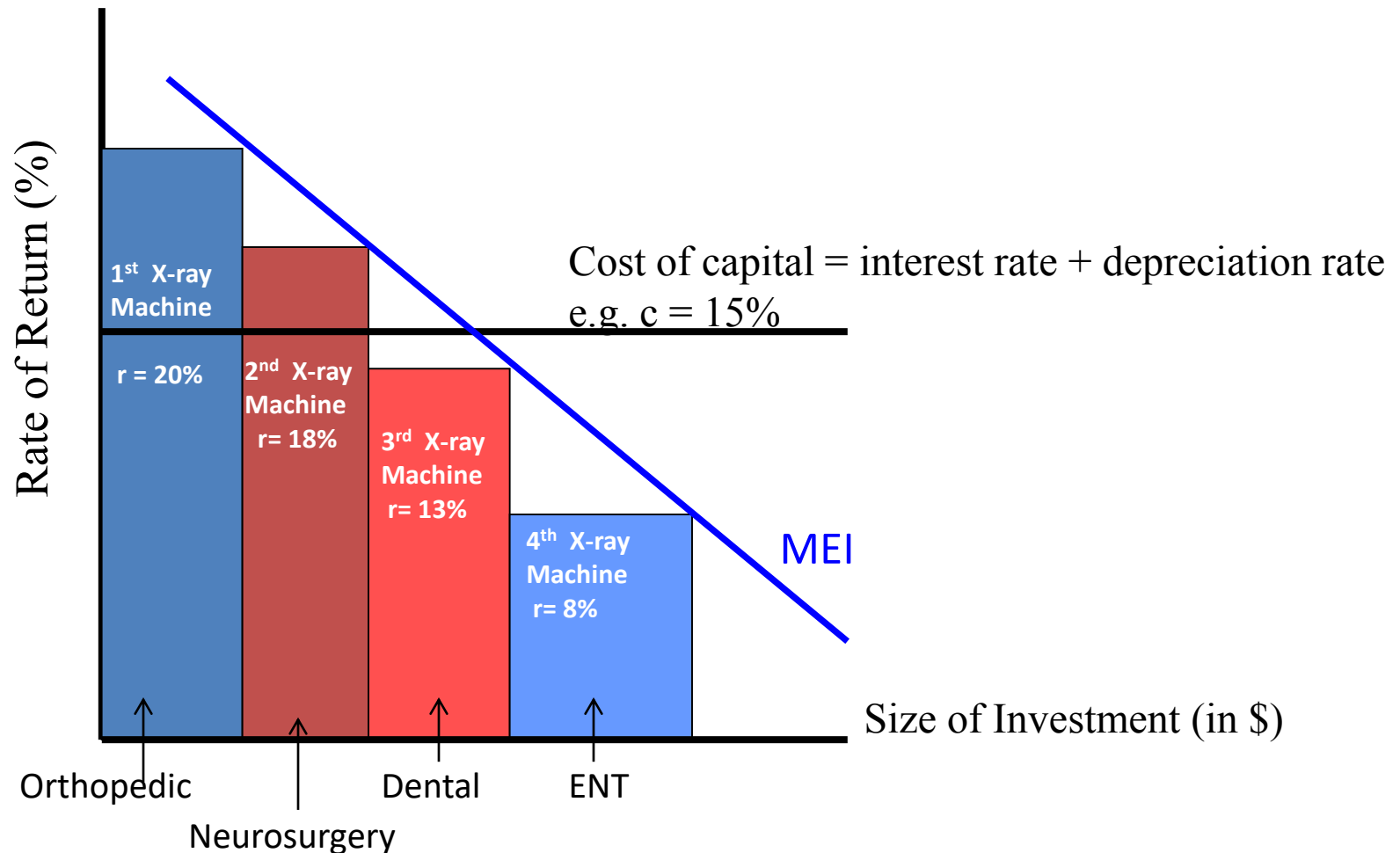
Cost of Capital

- The *cost* of an X-ray machine = \$100,000.
- Suppose the machine wears out to half of its value within five years
 - The *total depreciation cost* = \$50,000 (i.e. \$_____/year)
- Alternative: Invest in a saving account ($r=5\%$)
 - Year 1: $100,000 * 1.05 = 105,000$
 - Year 2: $105,000 * 1.05 =$
 - Year 3: $110,250 * 1.05 =$
 - Year 4: $115,763 * 1.05 =$
 - Year 5: $121,551 * 1.05 = 127,628$
 - *Total Incremental Revenue* = **27,628**
- Need the total revenue =

Demand for Health Capital

- Supply Side ($r + \delta$)
 - Cost of capital = Forgone interest rate (r) + Depreciation rate (δ)
- Demand Side
 - Rate of return on investment (γ)
 - Example: Suppose the return from the X-ray machine is \$20,000 each year.
 - The annual *rate of return* =
 - Marginal Efficiency of Investment (MEI): Describes the pattern of rates of return (γ).
 - *Rate of return declines* as the amount of investment _____.
- ***Optimal demand for health occurs at the intersection of the MEI curve and the cost of capital curve.***

Marginal Efficiency of Investment (MEI) and Rate of Return



Grossman's Health Capital Model

$$\text{Max } U = U(\phi, H_t, Z_t), \quad t = 0, 1, \dots, n$$

where H_t = health stock

$h_t = \phi H_t$: consumption of health services

Z_t = consumption of other commodities

Subject to :

$$H_{t+1} - H_t = I_t - \delta_t H_t$$

$$I_t = I_t(M_t, TH_t; E)$$

$$Z_t = Z_t(X_t, T_t; E)$$

$$\text{Budget constraint: } \sum_{t=0}^n \frac{P_t M_t + Q_t X_t}{(1+r)^t} = \sum_{t=0}^n \frac{W_t T W_t + A_0}{(1+r)^t}$$

$$\text{Time constraint: } T W_t + T H_t + T_t + T L_t = \Omega$$

F.O.C :

$$\textcircled{1} \quad \frac{\pi_{t-1}}{(1+r)^{t-1}} = \frac{w_t G_t}{(1+r)^t} + \frac{(1-\delta) w_{t+1} G_{t+1}}{(1+r)^{t+1}} + \dots$$

$$+ \frac{(1-\delta_t) \dots (1-\delta_{n-1}) w_n G_n}{(1+r)^n}$$

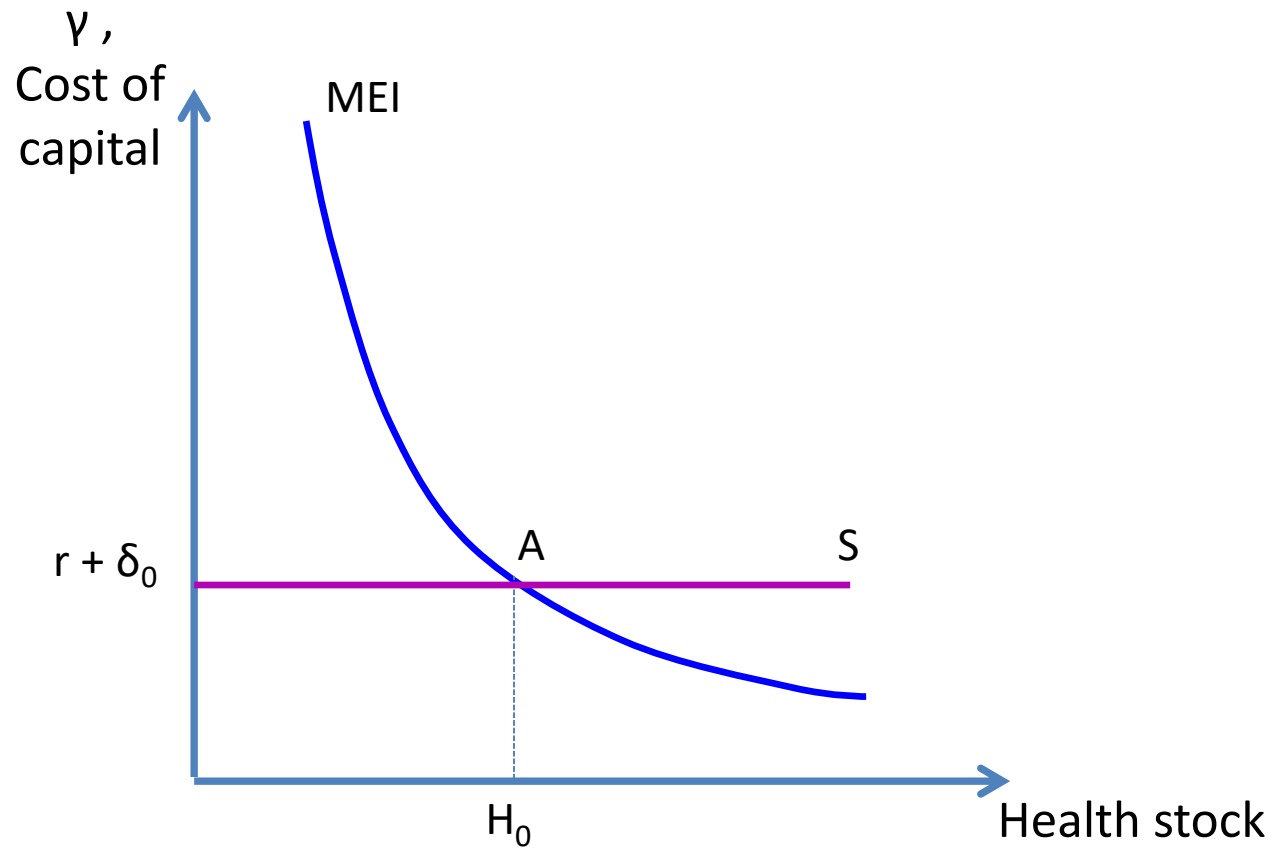
$$+ \frac{U_n}{\lambda} G_t + \dots + \frac{(1-\delta_t) \dots (1-\delta_{n-1}) U_n G_n}{\lambda}$$

$$\textcircled{2} \quad \pi_{t-1} = \frac{P_{t-1}}{\partial I_{t-1} / \partial M_{t-1}} = \frac{w_{t-1}}{\partial I_{t-1} / \partial H_{t-1}}$$

where $U_{h_t} = \frac{\partial U}{\partial h_t}$; $G_t = \frac{\partial h_t}{\partial H_{t-1}} = \frac{-\partial(TL_t)}{\partial H_t}$

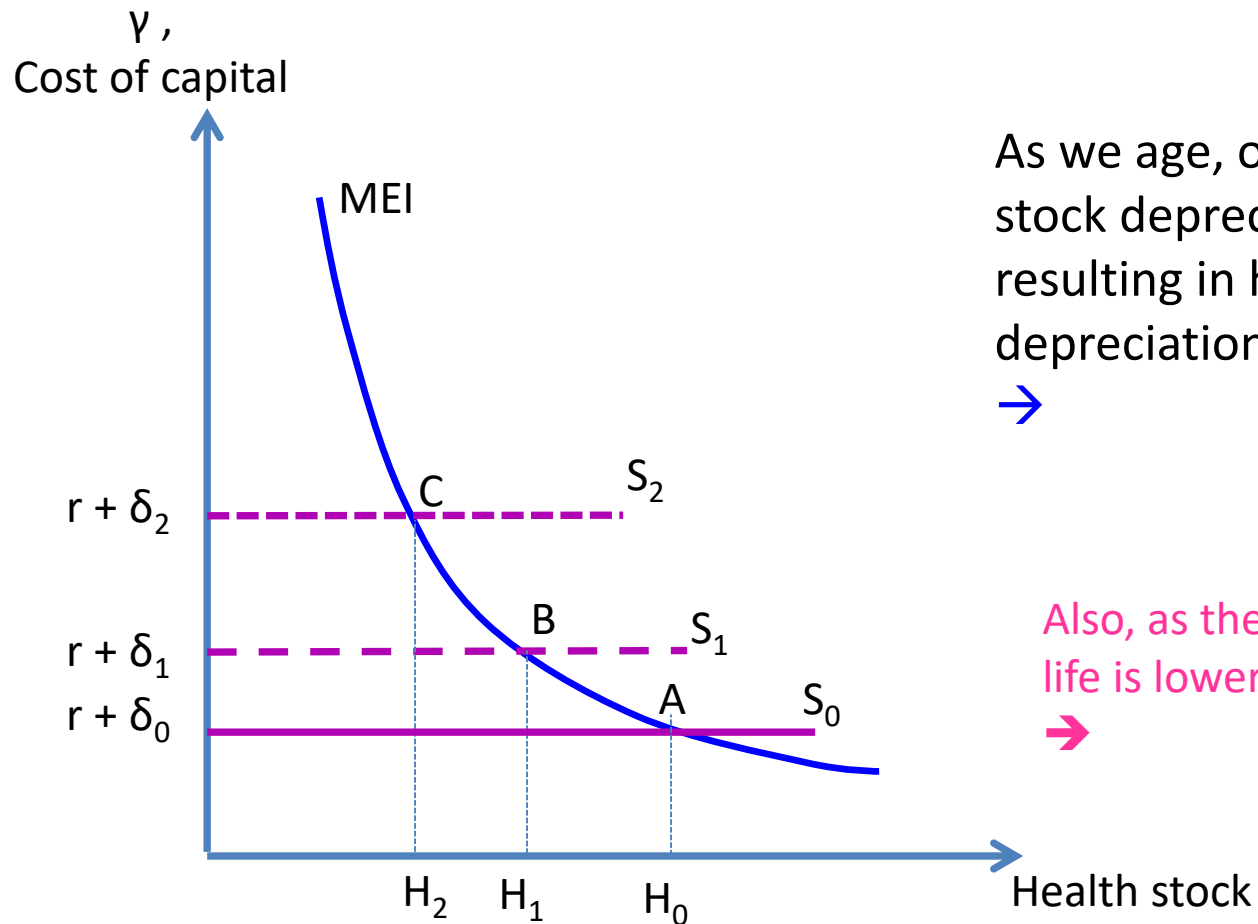
π_{t-1} = marginal cost of investment in H

Demand for Health Capital



Demand for Health Capital:

Impact of Age on Investment in Health



As we age, our health stock depreciates faster, resulting in higher depreciation rates.

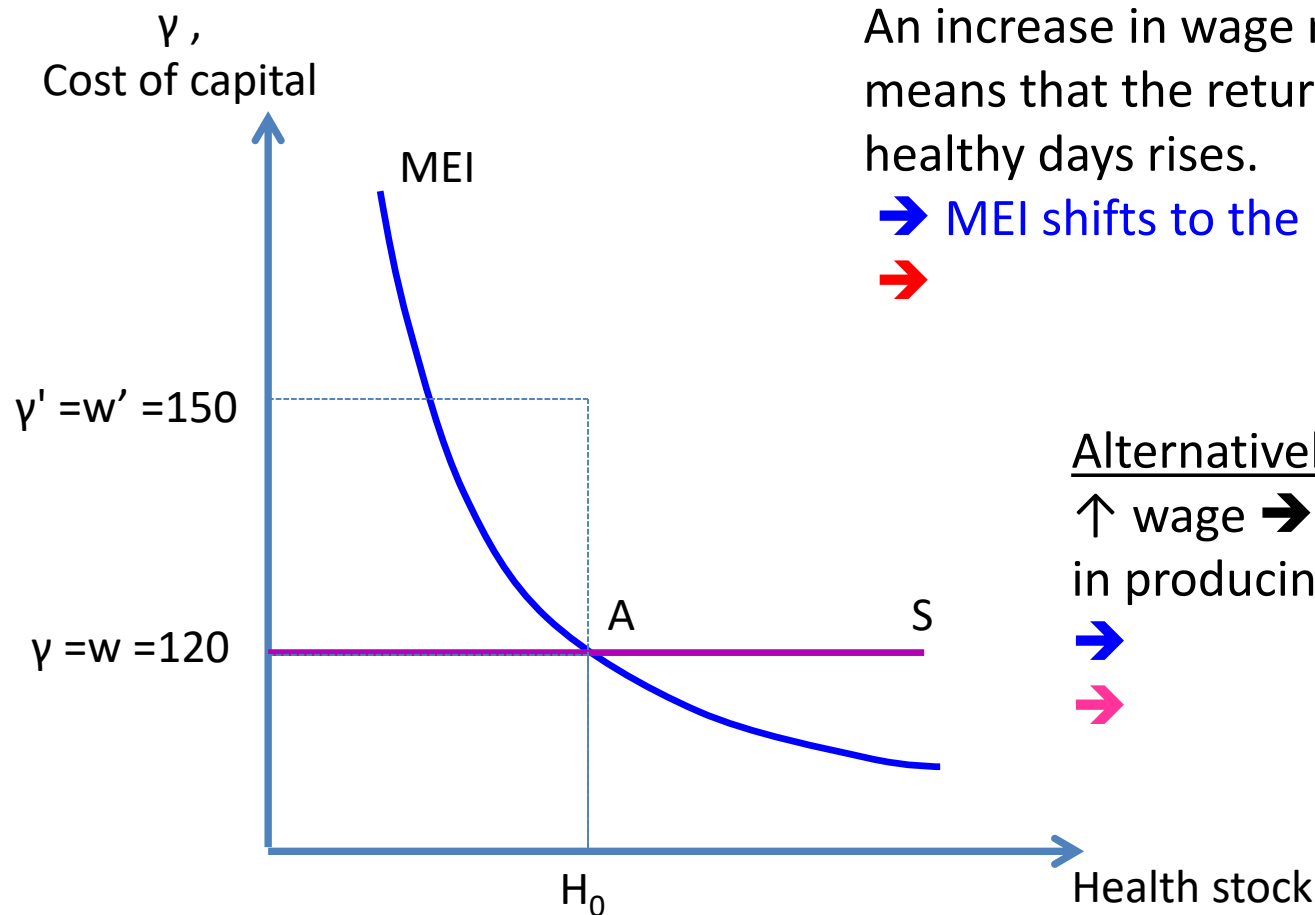


Also, as the expected length of life is lower, MEI decreases



Demand for Health Capital:

Impact of Wage on Investment in Health



An increase in wage rate means that the return from healthy days rises.

→ MEI shifts to the right .



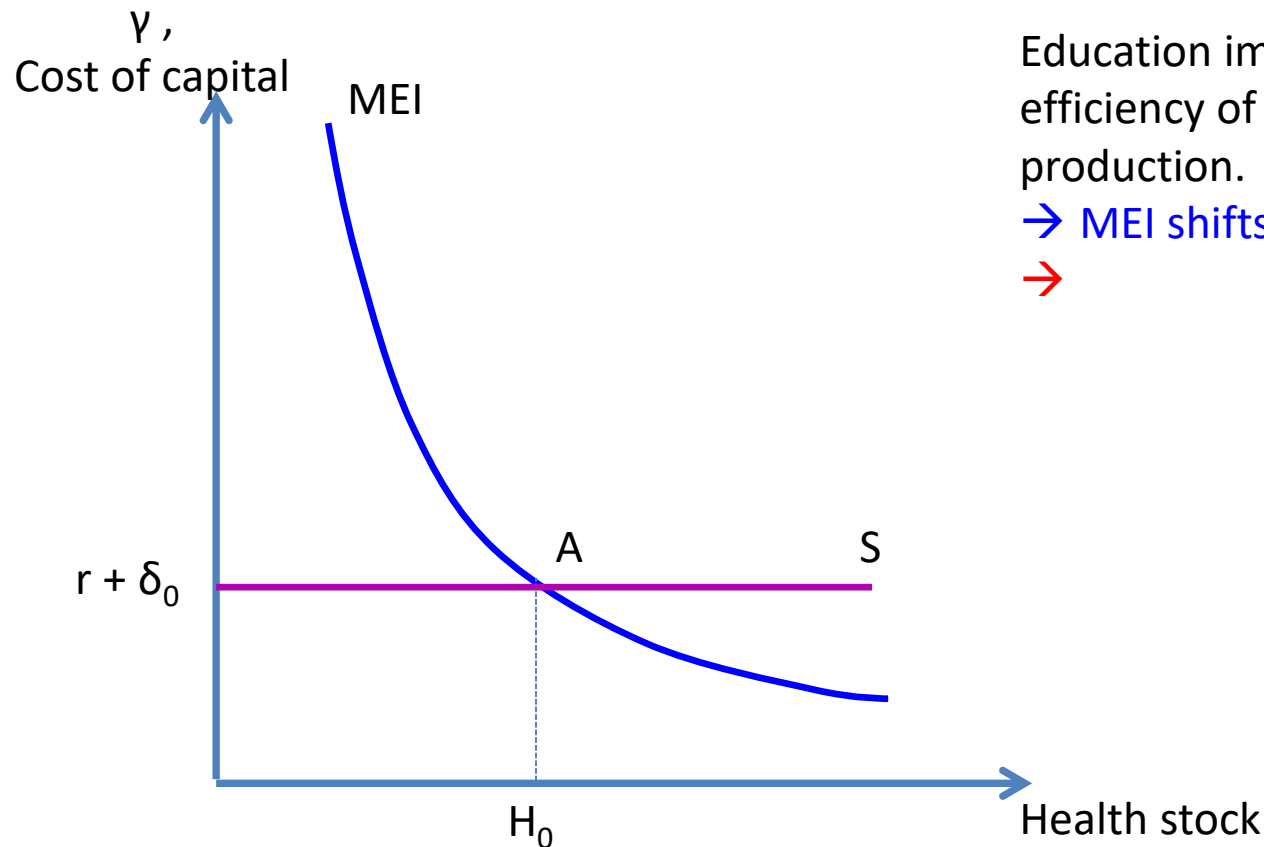
Alternatively:

↑ wage → ↑ opportunity cost in producing health.



Demand for Health Capital:

Impact of Education on Investment in Health



Education improves efficiency of the health production.

→ MEI shifts to the right.



Conclusions

- Health can be considered as a consumption good and an investment good.
 - *Trade-offs* between consuming **health** and consuming **other goods**.
 - *Trade-offs* between **time spent on producing health** and **time spent on working and on leisure**.
- The demand for health capital is determined by the **cost of health capital** and the **marginal efficiency of investment in health**.
 - Factors that affect the demand for health capital are such as: age, wage, education.