Production of Health (Part I)

EE 474 Health Economics

Semester 1/2012

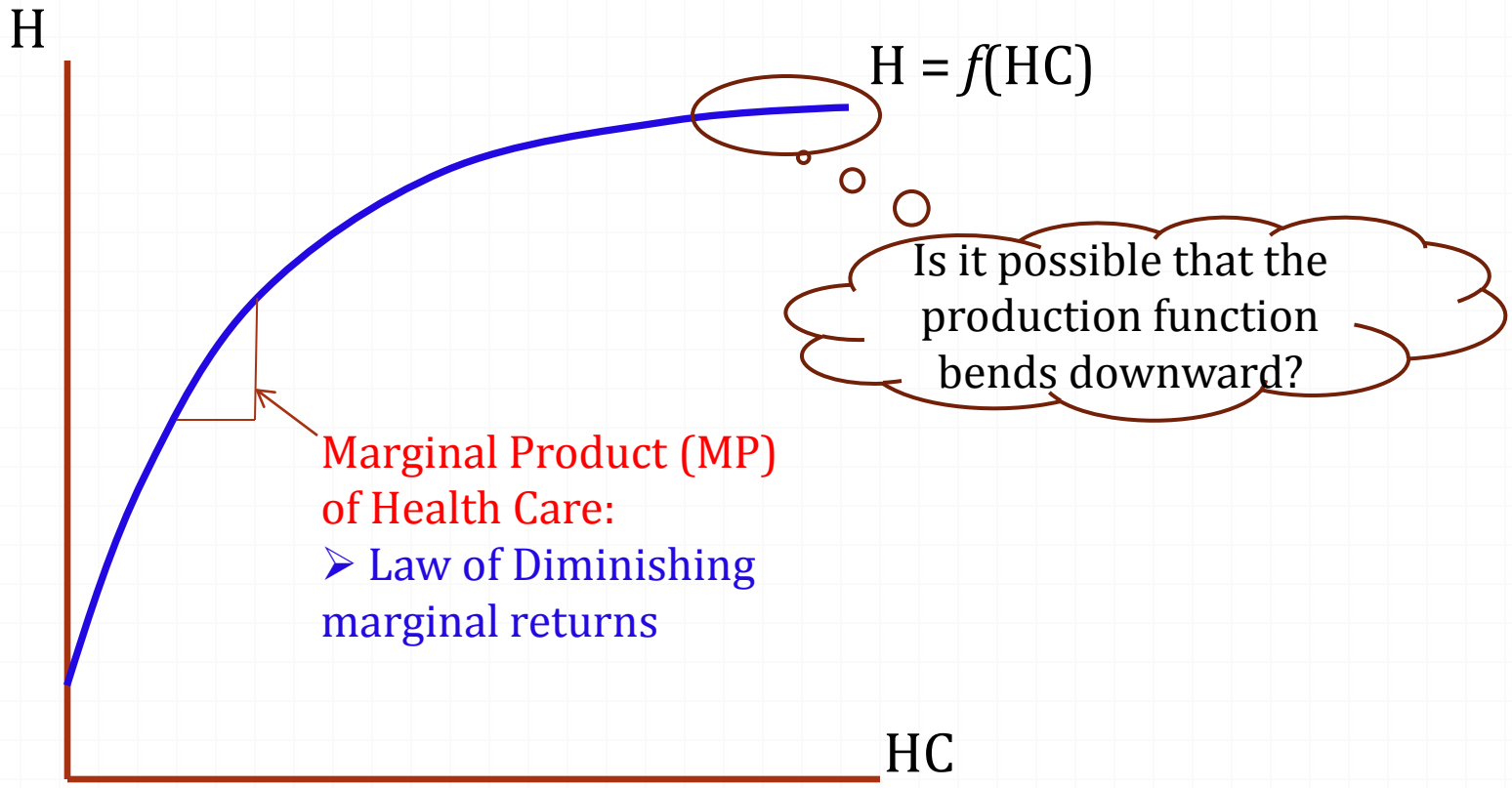
Topics

- Production function of health
- Health as a function of health care
  - Technical efficiency
  - Allocative efficiency
  - Some empirical evidence

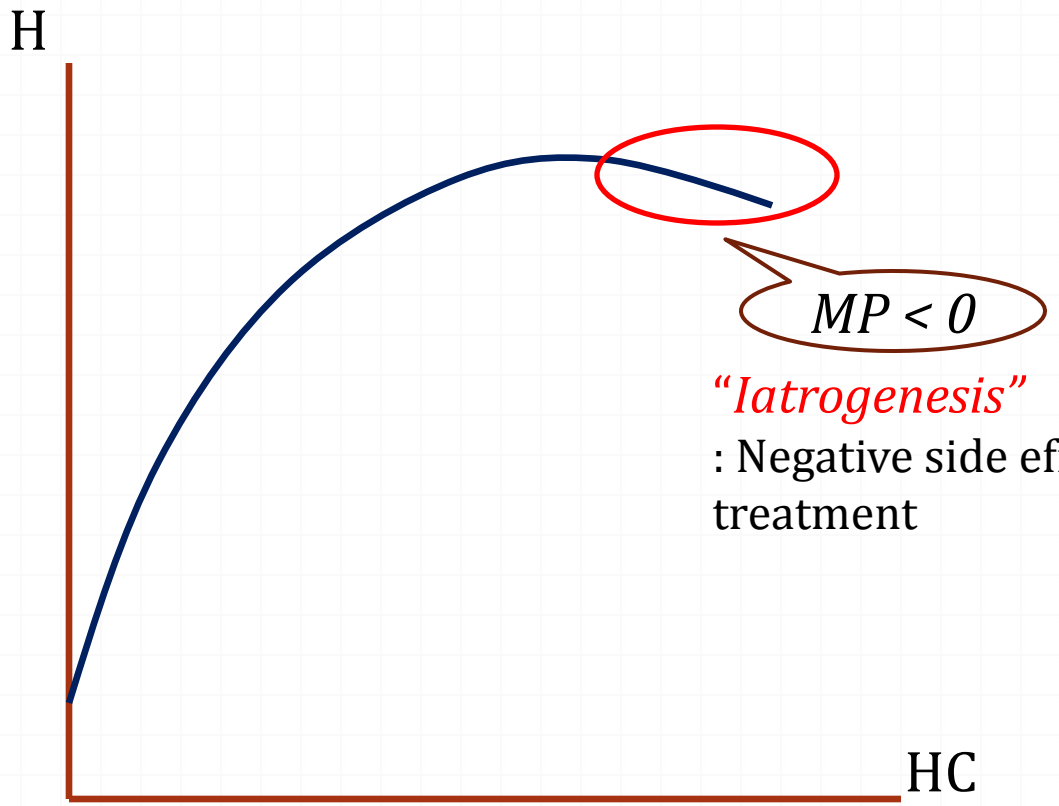
Production of *Health*

- Last time, the output of production was *health care*.
- In this lecture, *health* (or *health status*) is an *output*.
- What are possible inputs in the health production?
  - H = H(???)
  - H = H(**health care**, disease, nutrition, lifestyles, environment, public health, …)
- In this context, *health care is an input* in the production of health.

Production Function of Health



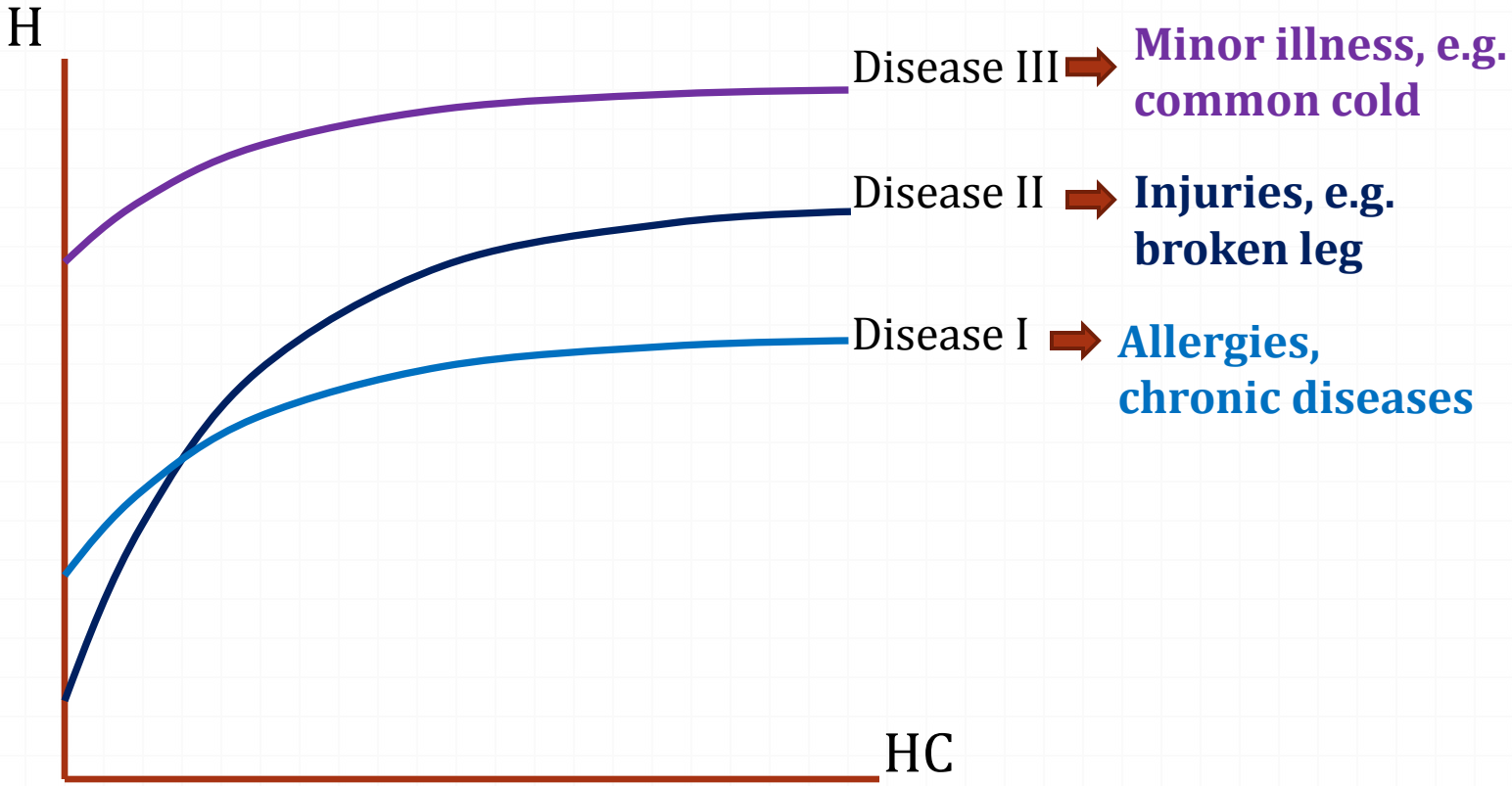
Production Function of Health When $MP_{HC} < 0$



"Iatrogenesis"

: Negative side effects of treatment

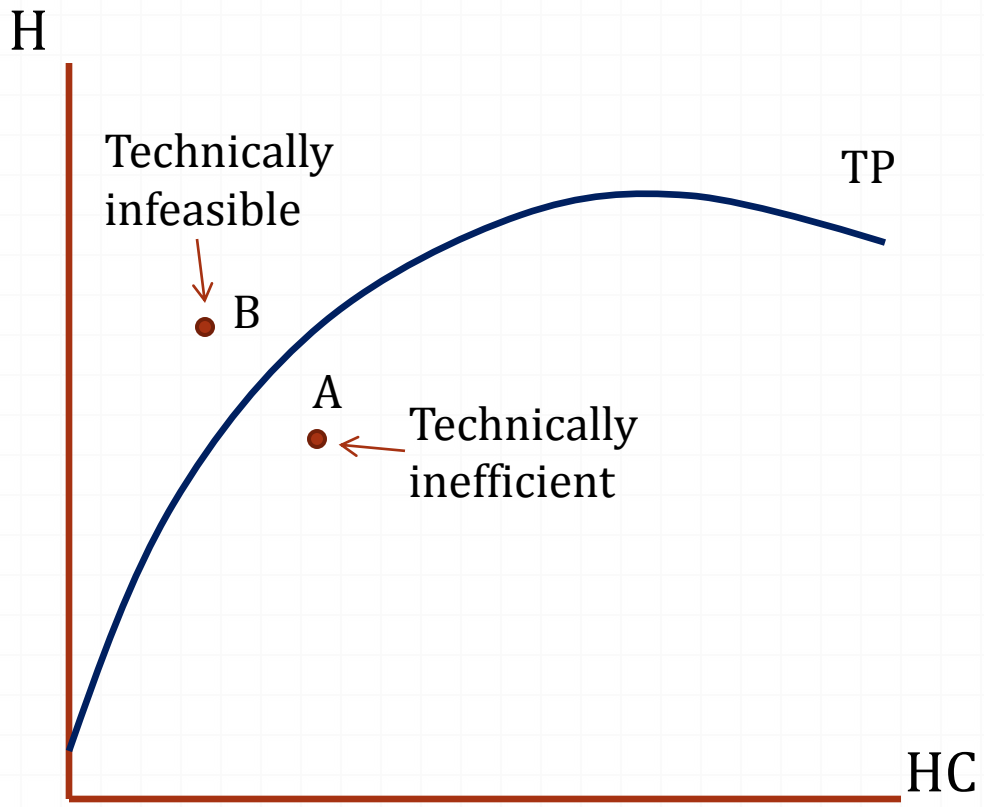
Production Function of Health for Different Diseases



Technical Efficiency

- Technical efficiency :
  - Produce the maximum amount of output from a given amount of inputs – *not wasting resources*
- The production function shows the maximum that can be produced by any set of inputs.
- So, the production function of health includes only *technically efficient* input-output combinations.

Production Function (1 Input)



Technical Efficiency (2 inputs)

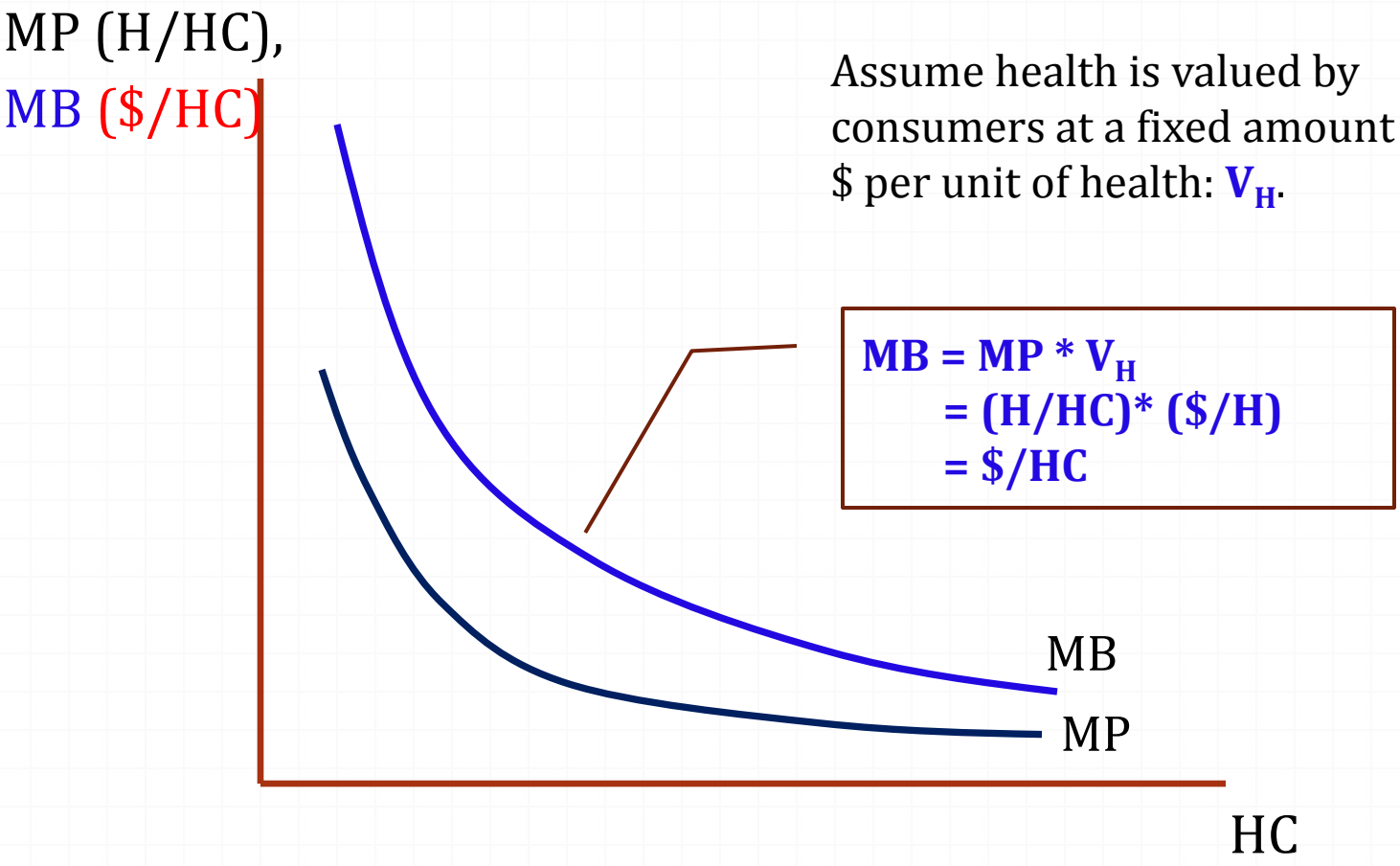
	Health	Health Care	Exercise
A	50	5	5
B	50	4	6.25
C	50	7	5

- Which combination is technically inefficient?
  - Combination C is inefficient because the same amount of output (health) can be produced with fewer units of health care if using combination A.

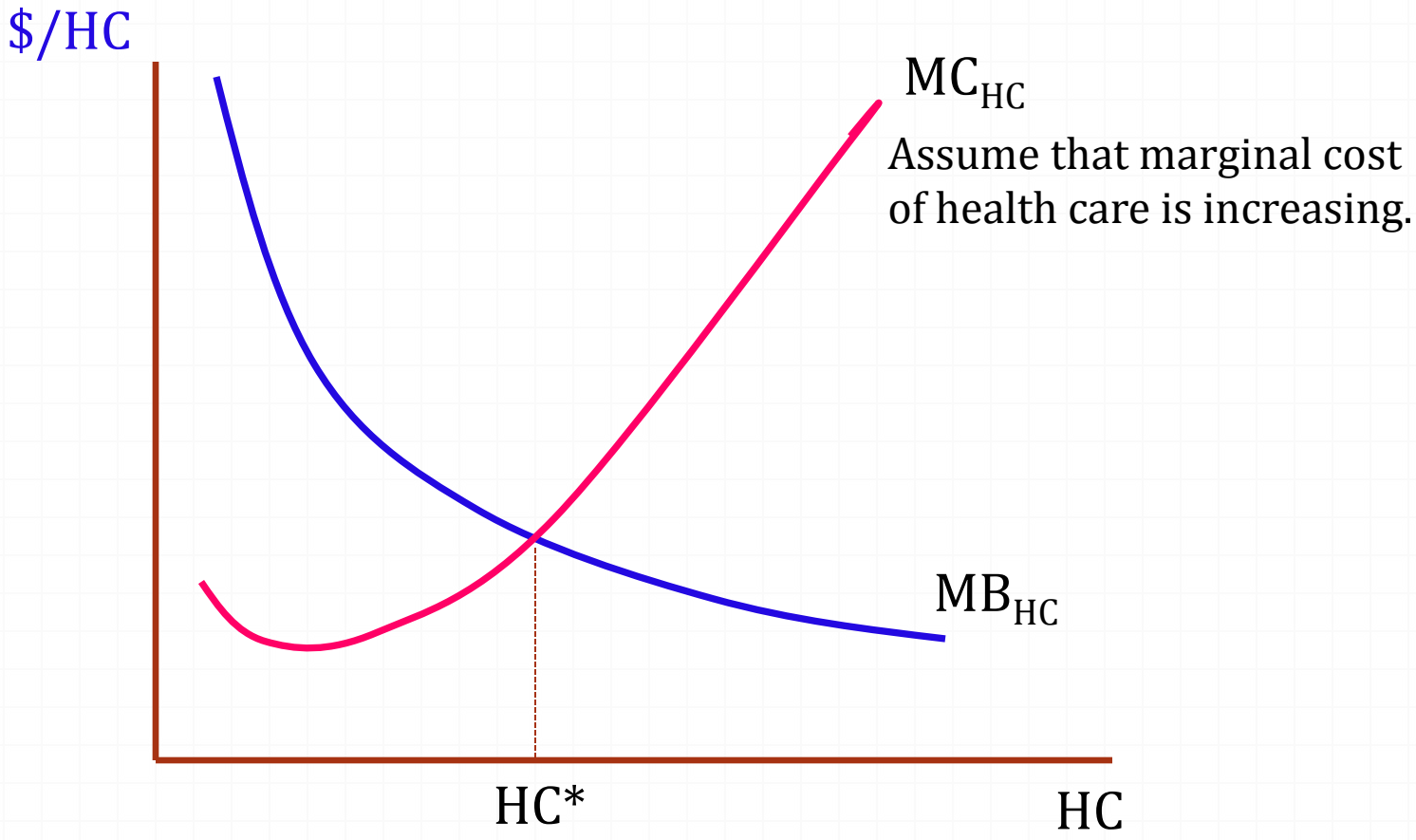
Is Health Care Worth It?

- Now, we turn to the society's perspective on the health production.
- Are we producing on the "*flat of the curve*"?
  - i.e. Is $MP_{\text{health care}} = 0$?
- What is the optimal level of health care for society to produce and use?
  - Need to know:
    - MP of health care
    - How much value of the health generated
    - How much each additional unit of health care costs

Marginal Product and Marginal Benefits of Health Care



Add Marginal Cost Curve



Allocative Efficiency

- Why is HC* optimal?
  - Because it maximizes the net benefit of health care.
- If HC < HC*, MB > MC:
  - By consuming more HC, total net benefits increase.
- If HC> HC*, MC > MB:
  - By consuming less HC, total net benefits increase.
- At MB = MC, *allocative efficiency* is achieved.

Allocative Efficiency under Constraints

- Last example illustrates a situation of the unconstrained choice – we could use as much HC as we'd like.
- In reality, due to *scarcity* of resources, any choices are constrained by available resources.
- To achieve allocative efficiency, we need a *new rule* to allocate spending over all the possible inputs for the health production, until the budget is used up.

Constrained Choice

- Rule for allocative efficiency under constraints:
  - Allocate spending over all different inputs for the health production so that *the value of the health gain from the last $ spent on each input is the same*:

$$\frac{MB_{HC}}{MC_{HC}} = \frac{MB_{Exercise}}{MC_{Exercise}} = \ldots = \frac{MB_{Public\ Health}}{MC_{Public\ Health}}$$

- If inequality exists (e.g. $MB_{HC}/MC_{HC} > MB_{Exercise} / MC_{Exercise}$), then spend more on health care and less on exercise.
  - MP of health care will decline & MP of exercise will increase.
  - Eventually, the benefit per $ spent on each input will be equal.

Empirical Evidence on the Relationship between H and HC

- Hadley, J. (1982). *"More Medical Care, Better Health?" An Economic Analysis of Mortality Rates.*
- RAND Health Insurance Experiment (HIE)

Hadley (1982)

- Estimate the impact of health care on health by using county-level data from 1970
- Regression function:

  Mortality rates = f(HC expenditure, educ, income, ..)

- Elasticity of health w.r.t. health care expenditure:

  E = (%ΔMortality rate)/(%ΔHC expenditure)

- Found small but significant elasticities: -0.12 to -0.17
  - A 1% increase in health care expenditure results in a 0.12% to 0.17% reduction in mortality rates.

Possible Biases in Estimating the Relationship between H and HC?

- Selection bias
  - In the health production function, we assume that an increase in HC leads to an increase in H.
  - But many people choose to consume more HC when they are sick, i.e. decrease in H causes an increase in HC.
  - This is called *reverse causality bias* → underestimation.
- Omitted variable that is correlated with H and HC:
  - Example: "Employment" – People who are employed are more likely to be healthy and use more health care because they have health insurance (or can afford health care).
  - Sometimes, this omitted variable is not observed.

RAND HIE

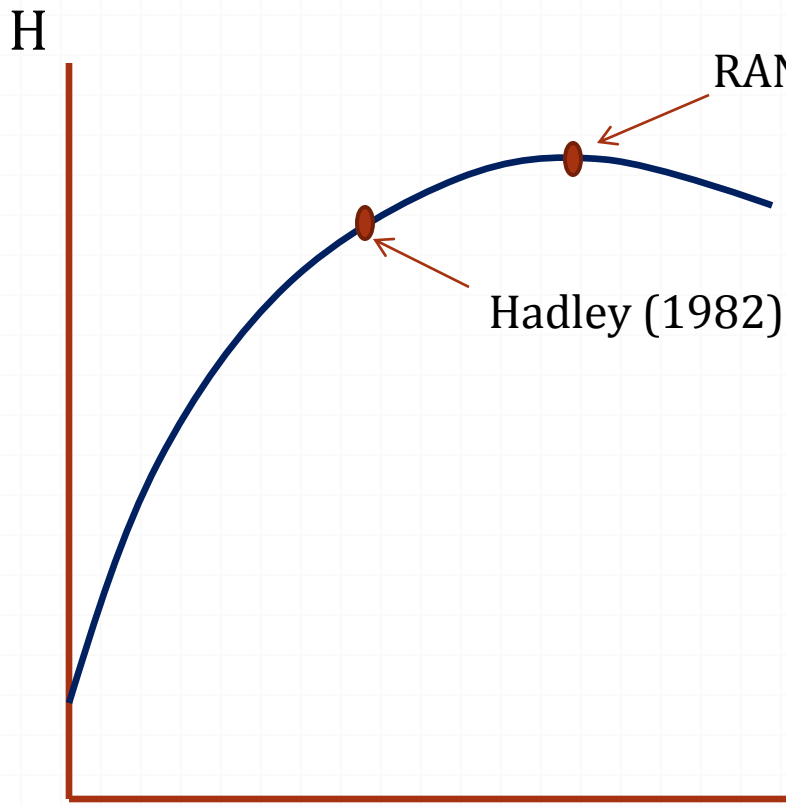
- To reduce the possible biases from observational data, an alternative to use experiments.
  - Natural experiments – expansion of health insurance coverage
  - Randomized controlled trials (RCTs)
- RAND HIE:
  - Designed to test the impact of different health insurance policies on demand for health care and health status
  - Participants are assigned to health insurance plans:
    - c=0, c=0.25, c=0.5, or c= 0.95
  - Found: people assigned to cost sharing spend 40% less on health care, compared to people who pay nothing (c=0).

RAND HIE

- Studies from the experiments show that the increase in health care had no effect on health.
  - *Brook et al.* (1983) found that the decrease in HC caused by cost sharing did not have any effect on H, except for worse corrected vision and worse blood pressure.
  - *Newhouse et al. (1993)* found that 40% increase in health care used by the fully insured had little or no effect on adults' health status (measured from work loss days).

Plan	Mean of Work Loss Days	s.e.
Free (c=0)	5.47	0.42
Intermediate (c=0.25, 0.5, 0.95)	4.82	0.37
Individual deductible	4.54	0.36

Summary of Empirical Evidence



Where are we, according to Hadley's and RAND HIE's studies?

Next Lecture

- Other inputs for the production of health
- Victor Fuchs (1974): Who Shall Live?