

Demand for health and health care

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Production Function of Health

- ▶ Our first economic model
- ▶ Defn: Relationship between inputs and outputs
- ▶ Assumptions:
 - ▶ more input means more output (positive relationship)
 - ▶ diminishing marginal product (bowed shape)

Example of a production function

- ▶ input: workers
- ▶ output: widgets
- ▶ prodn fcn gives how many widgets a worker can produce

| # Workers | Output |
|-----------|--------|
| 0 | 0 |
| 1 | 4 |
| 2 | 10 |
| 3 | 13 |
| 4 | 15 |
| 5 | 16 |

Example continued

- production function gets flatter and flatter as output rises
- ▶ first worker hired uses best machine
 - ▶ last worker hired uses worst machine, overcrowding so lowers pty of other workers
 - ▶ result of fixed inputs (factory size) – short-run only
- because of diminishing marginal product

Example continued

$$\text{marginal product} = \frac{\Delta \text{output}}{\Delta \text{labor}}$$

| # Workers | Output | Marginal Product |
|-----------|--------|------------------|
| 0 | 0 | - |
| 1 | 4 | 4 |
| 2 | 10 | 6 |
| 3 | 13 | 3 |
| 4 | 15 | 2 |
| 5 | 16 | 1 |

In health terms...

- ▶ **input:** health care
- ▶ **output:** health
- ▶ prodn fcn of health gives how much health certain amounts of health care can produce
- ▶ **assumptions:**
 - ▶ positive slope b/c health care improves health
 - ▶ gets flatter as health care rises
 - ▶ if never get care, first visit will do a lot
 - ▶ if get lots of care, one more visit won't do much
 - ▶ health care can only keep us so healthy so there is an upper-bound; however, new medical break-through could change that in long-run
 - ▶ never bends downward – more health care cannot worsen health
 - ▶ Can you think of any exceptions?

Exceptions to the never bends downward assumption

- ▶ iatrogenic – provider caused disease (hospital infection, risks of surgery, adverse reaction to drugs)
- ▶ medicalization leads to less personal effort to preserve health so more care leads to worse outcomes

Implication: Marginals are important for policy

- ▶ On average, medical spending is worth it:
 - ▶ LBW infant increased medical costs = \$39k between 1960-90, but increased value of life worth \$238k
 - ▶ cost of treating average heart attack increased \$10k between 1985-1999, increased life expectancy after heart attack by 1 year = \$100k
- ▶ At the margin though, we are wasting money
 - ▶ marginal product of health is low at current levels of expenditures, (wouldn't we be better off spending that last billion dollars on something else – education, environment, etc.?), or
 - ▶ inefficient usage (below the production frontier) – could be getting more health for given level of input

Flat of the curve diagram

Which inputs matter?

Really, more than 1 input: $H = f(X_1, X_2, \dots, X_n)$

- ▶ Medicine and health care
- ▶ Lifestyle
- ▶ Environment
- ▶ Human biology
- ▶ Social circumstances

Medicine and health care

- ▶ small contribution historically – mortality declines for diseases before medical intervention available
- ▶ antimicrobial drugs invented in 1930s reduced infant deaths
- ▶ immunizations
- ▶ impact in modern days – there is some debate about magnitudes
 - ▶ David Cutler would say medical care is responsible for 50% of the increase in longevity between 1950 and 2000.
 - ▶ public health literature say 10-15%

Lifestyle

- ▶ nutrition – helps body fight off infection
- ▶ substance use – smoking & alcohol
- ▶ risky sex
- ▶ exercise
- ▶ stress
- ▶ maternal behavior

Environment & Human Biology

- ▶ Environment: sanitation (water, sewer, food handling), pollution
- ▶ Human Biology: genetic makeup

Social circumstances

- ▶ income – the gradient; why are income and health related?
 - ▶ behavior
 - ▶ medical care (qty and quality)
 - ▶ environment (live in better areas, less pollution, crime)
 - ▶ biology (beauty, Barker's Hypothesis)
 - ▶ sick can't work productively so poorer
 - ▶ education – two theories:
 - ▶ Grossman – better-educated people understand how to keep healthy
 - ▶ Fuchs – forward-thinking people tend to invest in education and health, so just correlated
- Which economist would recommend spending more on education to improve health?

Evidence: Difficult to estimate the production function

How do you measure health?

- ▶ mortality rate – accurate, but doesn't capture pain, suffering
- ▶ morbidity (illness) rates – have to go to doctor to know that you are sick; rich could have higher rate than poor just because go to doctor more often
- ▶ disability days – what if don't work?
- ▶ self-reported health status – depressed people say they are really sick

Evidence: Difficult to estimate the production function

How do you eliminate biases from the estimates?

- ▶ Estimate effect of health care on health – people who get a lot of health care tend to be sicker than those who don't need to go to the doctor; would appear that health care makes you worse
- ▶ Estimate effect of income on health – could be that sick people can't work much so poor; would appear that income has a bigger effect on your health than the true effect

Evidence: 3 methods for dealing with bias – 1

Fixed Effects – use multiple observations on a person or family and look for differences in behavior and outcomes

e.g. mom has multiple babies, goes to the doctor a lot for first, but not for later order births, how did outcomes change?

Evidence: 3 methods for dealing with bias – 2

Difference in Differences – use variation across state and time

e.g. MA insurance change, CT no change, look at increased insurance effect on health pre and post

| | MA | CT | Diff |
|------|----|----|------|
| Pre | 10 | 5 | -5 |
| Post | 15 | 7 | -8 |
| Diff | +5 | +2 | +3 |

Evidence: 3 methods for dealing with bias – 3

Instrumental Variables – estimate effect due to exogenous change

e.g. random schools have anti-smoking counseling, others don't, what is the effect of smoking on later health for those who smoked but would have not smoked if had counseling?

Elasticity

- ▶ Defn a measure of the responsiveness of x to changes in y .
- ▶ Answers this question By what percentage does x change when y changes by 10%?
- ▶ We use elasticities so that the estimates are not sensitive to units (dollars, number of visits, etc)
- ▶ inelastic - not responsive
v. elastic - very responsive
- ▶ y elasticity of $x = \frac{\% \Delta \text{ in } x}{\% \Delta \text{ in } y} = \frac{\Delta x/x}{\Delta y/y}$

Elasticity tips

- ▶ elasticity is like slope
 - ▶ slope ($= \frac{\text{rise}}{\text{run}} = \frac{\Delta y}{\Delta x}$)
 - ▶ elasticity $= \frac{\Delta x}{x} \frac{\Delta y}{y} = \frac{1}{\text{slope}} \frac{y}{x}$
- ▶ elastic is horizontal (like E); inelastic is vertical (like I)

Research findings: Health care

- ▶ health care elasticity of health is about .10
- ▶ So: if health care expenditures increased 10%, then health would improve by 1% ($10\% \cdot .1 = .01$) – small effect
- ▶ Bigger elasticity for certain subgroups (women, blacks)
- ▶ Rand Health Insurance Experiment evidence:
 - ▶ groups randomly assigned to insurance plans, effect of plan type on spending and health
 - ▶ which method is this?
 - ▶ groups who paid more out of pocket, consumed 40% less health care
 - ▶ there was no difference in health status between groups

Research findings: Lifestyle and environment

- ▶ Fuchs Nevada/Utah study:
 - ▶ same income, medical care, but Mormons in Utah don't smoke or drink or have risky behaviors
 - ▶ Which method is this?
 - ▶ death rates in Nevada are much higher
- ▶ smoking, especially prenatally, has been shown to be very bad
- ▶ pollution – reducing pollution by 100 mg/m³ would reduce death by 6%
- ▶ Business cycles – Ruhm finds that when unemployment falls, physical health worsens; because workplace accidents, traffic accidents, smoking, drinking, obesity increase in good times

Research findings: Income

Complicated set of findings

- ▶ Marmot Whitehall Study – high ranks healthier than lower ranks (implies income affects health)
- ▶ gradient observed even among kids who don't earn income (implies income affects health)
- ▶ Pritchett and Summers (1996) extremely low incomes are very bad for health
- ▶ But, declines in mortality since 1950 cannot be explained by income gains alone

Research findings: Education

- ▶ Lleras-Muney – people who get more education because of compulsory education law changes (not a choice of their own) are healthier – which method?
supports Grossman or Fuchs?