Demand for health capital.
Folland *et al* Chapter 7

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Chapter 6: The Production, Cost, and Technology of Health Care

- ▶ We're basically skipping this chapter (but you are expected to know main concepts!)
- ▶ It's the Econ 103 analysis of input choice and production (e.g., using labor and capital to produce widgets) applied to health.
- ▶ Examples largely from U.S. hospital sector.

Chapter 7: Demand for health capital.

- ▶ Goal here is to develop a model we can use to study how people make choices which affect their health.
- ▶ Off–the–shelf models of say, demand for apples probably not suitable:
    - ▶ Health is a **stock**, not a **flow**.
    - ▶ Health is a derived demand: e.g., people want health, not health care.
    - ▶ People produce health using multiple inputs, e.g., you may buy an exercise bike, use your time on the bike, and eat some spinach after.

Grossman 1972

- ▶ The model we will sketch here is due to Grossman (1971)
- ▶ Very, very highly cited paper. Framework and extensions commonly used in theoretical and empirical research.
- ▶ Built in turn on Becker (1966) "home production" model.

Basic notions

- ► People's goals are health and "home goods."
- ► "Home goods" = everything except work, "bread," "entertainment" or "leisure" extremely broadly defined.
- ► Use time and resources (money) to produce these goals.
- ► Dynamic model: takes into account how decisions today affect outcomes in the future.
- ► (graph: health vs bread ppf)

Health capital.

- Very useful to think of health as like physical capital in standard theory.
- Health evolves over time. A rise or fall in health does not immediately vanish.

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

where $\delta_t \in [0, 1]$ represents (age–dependent) decay in health, $H(t)$ is health status at age t, and $I(t)$ is investment in health.

Health investment.

- ▶ We invest in health much like we think of firms investing in capital stock.
- ▶ We use inputs (medical care, diet, exercise, time) to produce an increment in health status (physical health, mental health).
- ▶ Health care in this model is a **derived demand**, care is valued because it produces health, and people actually want health not health care.

Why do people value health?

1. **Consumption**: People directly value health because they enjoy life more when healthy.
2. **Investment:** Good health allows people to work more hours and to be more productive per hour worked.
3. Good health increases length of life.
4. (Graphs: time lost due to illness as function of health, backward-bending health/bread ppf)

Budget constraint.

The value of the goods the person is able to purchase cannot exceed his income, where we think of both purchases and income over the life cycle.
We take into account that healthier people tend to earn more and to live longer.

Time constraint.

- Production of health depends not just on stuff (health care, food, etc) but also on time (e.g., exercise).
- If we measure time in days, the annual time constraint is

$$365 = T_H + T_B + T_L + T_W \tag{2}$$

where
T_H time spend producing health
T_B time spent producing home goods
T_L time lost to illness
T_W time spent working

Production of health

▶ We can model investment in health with a function

$$I_t = I(M_t, T_{Ht}) \qquad (3)$$

where M is market goods used to produce health and T_H is time spent producing health.

▶ Similarly, model other stuff people do with time and money, "home goods," as

$$B_t = B(X_t, T_{Bt}) \qquad (4)$$

▶ (graph: health isoquants)

Education and other production function shifters

In this framework, education, or intelligence, or knowledge, or other characteristics which allow more health for given time and money inputs are modeled like,

$$I_t = I(M_t, THt; E_t) \tag{5}$$

where E_t is a measure of education at time t, such that I is higher when E is higher for given levels of money (M) and time (T_H).
(graph)

Summary of framework.

- People care about their health both directly and because health helps them earn income.
- People also care about other stuff, and produce health and other stuff using market goods and time.
- Health decays over time and people invest in health to increase their "stock."

Optimal investment in health

- ▶ Consider first a firm trying to decide how many machines to buy.
- ▶ Say the firm can earn 10% in an outside investment. A machine costs $1,000.
- ▶ If the first machine generates net revenues of $200 per year indefinitely, the firm should buy it, because the rate of return is 200/1000=20%.
- ▶ The firm should keep buying machines until the marginal machine's net revenues per year are less than $100, or 10% rate of return.
- ▶ Rule: keep investing until marginal rate of return (called MEI) equals rate earned on outside opportunites plus rate of depreciation, MEI=$r + \delta$.

Optimal investment in health cont.

- ▶ Same rule applies when thinking about health: keep using time and money to become healthier until the rate of return from this investment equals the rate of return you'd get from other investments.
- ▶ (graph)

- ► The model predicts changes in how much, and which inputs, people use to produce health as their circumstances change (age, wage, education, interest rates, etc)
- ► Simplified equilibrium notion: keep investing in health until MB=MC. MB depends on present value of benefits to increased health as above, MC on time and money costs of producing health and health depreciation.
- ► (graphs)

Assessing the model.

- ▶ Deliberately simplifies behavior: no uncertainty, one type of health and one home good, "black box" health production, geometric discounting, and so on.
- ▶ But still richer and more realistic than basic treatments: models health over the life cycle, and explicitly models the allocation of time.
- ▶ Many extensions since 1972. e.g., what happens if health changes have a component which is random from the person's point of view?
- ▶ Popular in part because lends itself easily to statistical applications.
- ▶ Many of the topics we will discuss later in the course are modeled using variants of this approach.

Further reading.

Grossman, M. (1972) "On the concept of health capital and the demand for health," Journal of Political Economy 80(2):223–55.
Grossman, M. (2000) "The human capital model of the demand for health," in Handbook of Health Economics, A. Culyer and J . Newhouse (eds), Elsevier. (Also available from: http://www.nber.org/papers/w7078.pdf).