Individual-level
demand for and
production of
health.

Demand for
Health.

Individual-level demand for and production of health.
Hurley, Chapter 5

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Hurley chapters we're skipping (for now):

- ▶ Chapter 2: Equity and efficiency
- ▶ Chapter 3: Basics of markets
- ▶ Chapter 4: Methods of economic evaluation
- ▶ I will assume you already have an Econ 103 level understanding of chapters 2 and 3, and we will return to chapter 4 if time permits.

Chapter 5: Individual-level demand for and production of health.

- ▶ Our goal is to understand what determines the choices people make that affect their health.
- ▶ We will use theoretical models to help us understand these choices and to interpret data.
- ▶ A foundational model we will focus on is due to Grossman (1972).

Basic ideas.

- ▶ We assume people have goals and tend to select behaviors to help them achieve those goals.
- ▶ One important goal is to be healthy, safe, and long-lived, but this is not the only goal.
- ▶ We face *tradeoffs* when making choices that affect our health.
- ▶ Graphs: PPF (next slide), equating marginal costs and benefits.

(iii) The Optimal Combination of Health and Entrainment

Health

H*

V
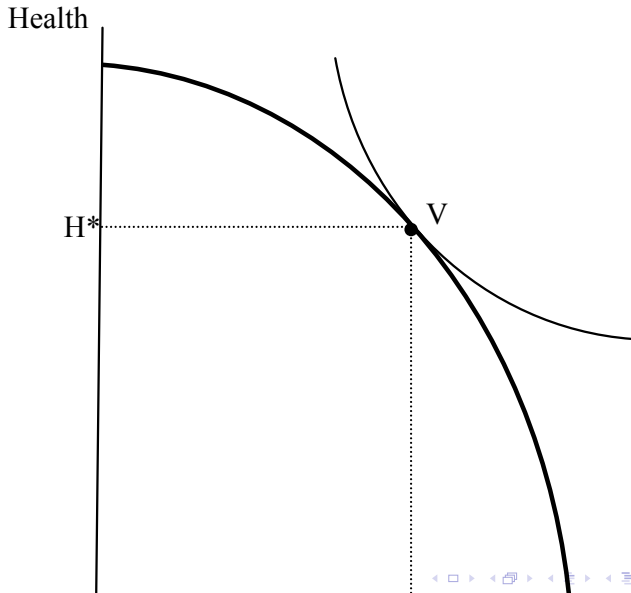
Modeling health over the lifecycle.

- Off–the–shelf models of say, demand for apples do not capture important aspects of health:
- 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's model.

- ▶ The model we will sketch here is due to Grossman (1971)
- ▶ Very highly cited paper. Framework and extensions commonly used in theoretical and empirical research.
- ▶ Built in turn on Becker (1966) "household production" model.
- ▶ We will have this framework in mind when we discuss topics like smoking, obesity, illicit drugs, and health care use.

Basic notions

- ▶ People's goals are health and "home goods," "bread," or "entertainment."
- ▶ Use time and resources (money) to produce these goals—tradeoffs!
- ▶ Dynamic model: takes into account how decisions today affect outcomes in the future.

Health capital.

- ▶ Very useful to think of health as like physical capital in standard theory.
- ▶ Health evolves over time. An increase or decrease in health does not immediately vanish.

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

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.

- ▶ (graphs—δ_t over time, an H_t profile over time)

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. **Longevity:** Good health increases length of life.

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.

Production of health

- We can model investment in health with a function

$$I_t = I(M_t, TH_t) \qquad (2)$$

  where M is market goods used to produce health and TH is time spent producing health. (graph-isoquants)

- Similarly, people produce "home goods" using time and money.

Goals and constraints.

- ▶ People make choices today which affect them over the rest of their lives.
- ▶ They try to make choices which give them desirable combinations of health and "entertainment."
- ▶ We can't have everything we want: we only have so much time and so much money.

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.

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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

$$365 = TH + TB + TL + TW \qquad (3)$$

where
TH	time spend producing health
TB	time spent producing home goods
TL	time lost to illness
TW	time spent working

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."

Predictions.

- ▶ The model predicts changes in how much, and which, inputs, people use to produce health.
- ▶ The model predicts how health will change as wage rates change and as education changes.
- ▶ Our first stab at thinking about how labor markets, the education system, and health are interrelated.
- ▶ We'll consider predictions under the simplification that the consumption value of health is zero.

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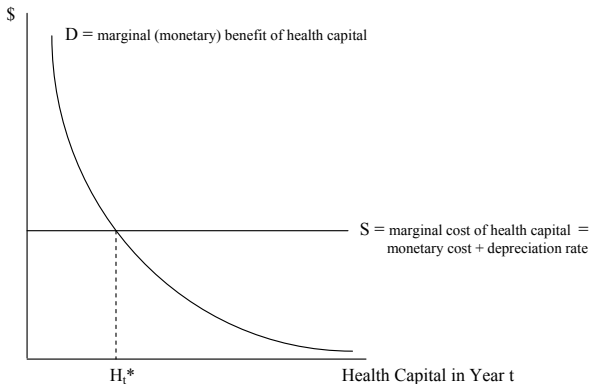**Figure 5.1: The Optimal Level of Health Capital**

Figure 5.1. The optimal level of health capital in period t (H_t^*) is that level at which the marginal benefit of a unit of health capital (as indicated by the downward sloping demand curve) equals the marginal cost of health capital (as indicated by the supply curve, which is assumed to be constant with respect to health capital).
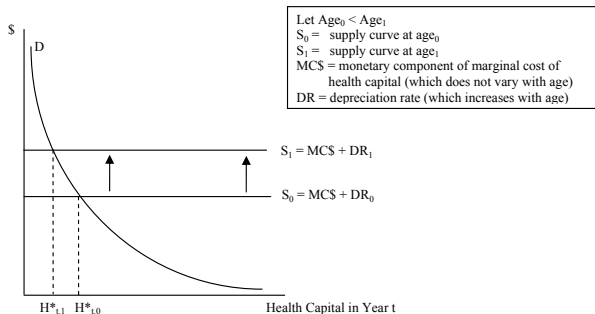
Aging.

- ▶ Physiological process of aging modeled as increase in rate of depreciation.
- ▶ As we age, must increase investment in health to maintain a given stock of health.
- ▶ Generally optimal to **choose** lower health as we get older.
- ▶ Whether health care usage goes up or down depends on elasticity of MEI schedule.

Figure 5.2: The Impact of Aging, Wages and Education on the Optimal Level of Health Capital under the Investment Demand Model

(i)   Aging

Let $Age_0 < Age_1$
S_0 = supply curve at age_0
S_1 = supply curve at age_1
MC\$ = monetary component of marginal cost of
       health capital (which does not vary with age)
DR = depreciation rate (which increases with age)

$S_1 = MC\$ + DR_1$

$S_0 = MC\$ + DR_0$

\$

D

$H^*_{t,1}$ $H^*_{t,0}$ Health Capital in Year t

Education.

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

$$I_t = I(M_t, THt; E_t) \qquad (4)$$

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)

Figure 5.2 cont'd: The Impact of an Increase in Depreciation Rate, Wages and Education on the Optimal Level of Health Capital, cont'd

(iii) Increase in Education

E_0 = initial education level
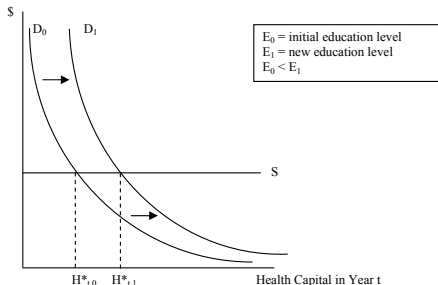E_1 = new education level
$E_0 < E_1$

Figure 5.2. As a person ages, the depreciation rate of health capital increases, raising the marginal cost of health capital and decreasing the optimal level of health. As wage rate increases, the marginal benefit of health capital increases (because working time is now more valuable), causing the optimal level of health to rise. Finally, an increase in education makes a person more productive, increasing the marginal benefit health capital and the optimal level of health.

Other possible effects of education.

- ▶ Education may change preferences (graph, PPF health/entertainment).
- ▶ Education may increase efficiency (geaph, move to PPF frontier).

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).