

The Production of Health

1. How to think about health care. What is the good?

- Dentist drilling out tooth
- Physical exam
- Eating our vegetables

What gives us Utility is what we derive from the action.

We all have some reservoir of health that we want to make as big as possible, all else equal.

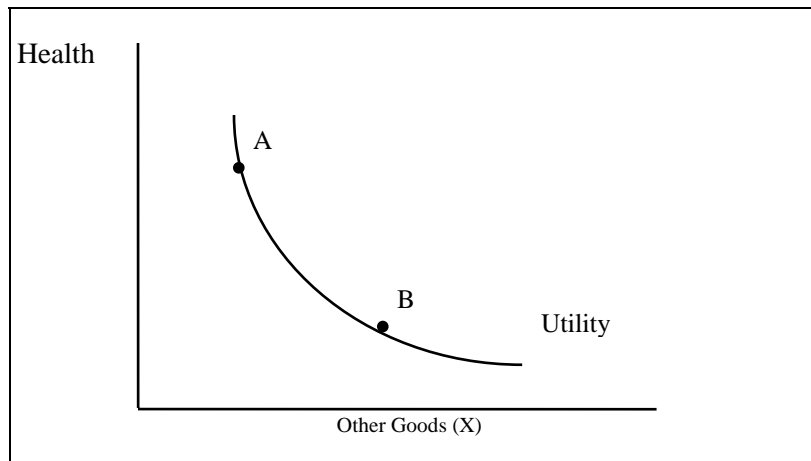
Health is a durable good (like a car, house, refrigerator, etc.) We are endowed at birth with a stock of health and the rest of our lives we make choices that affect that stock.

As consumers our ultimate goal is to maximize our utility

$$U = f(X, H) \text{ where } X \text{ is other things and } H \text{ is our stock of health}$$

Note the interdependence of X and H: if H increases MU_X increases, if X increases MU_H increases

We can think of health care as things that increase our stock of health



Note the IC goes asymptotically toward infinity: all the X in the world is not good unless you have some health and vice versa.

We will come back to this in deriving the demand for health care, but note that it is not bad to consume French fries or cigarettes as long as we understand the costs involved!

Almost 40% of deaths for those aged 15-24 due to vehicle crash - raise driving age to 25?
Smoking increases the risk of heart attack by 2.5 times, high cholesterol by 2.4 shouldn't we ban these as well?

2. The Production of Health

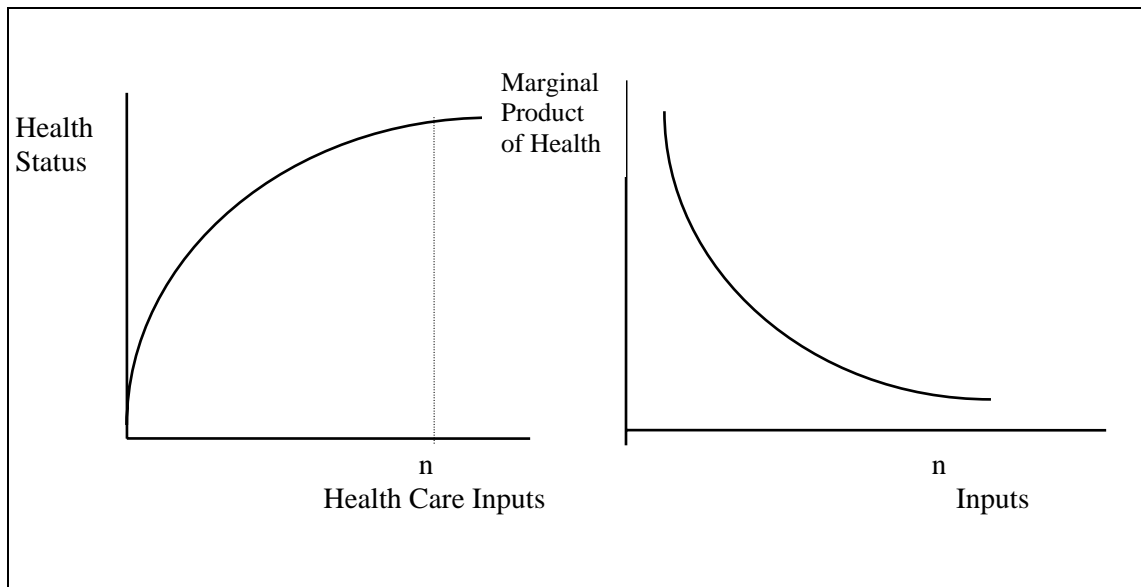
A. Why look at the production function?

1. Understand the relationship between the amount of health care used and the resultant change in health - how much of downward trend in mortality rate and increased life expectancy is due to practitioner provided health care?
2. Ask questions about the efficiency of current production process - can we re-allocate our resources and increase efficiency? - or what is the marginal product of health care?

B. How to think about the production function

Our stock of health is a function of lots of things:

$$HS = F(\text{health care, life style, environment, X})$$



Health care is some aggregate measure, maybe total expenditures. Note we are holding constant all the other inputs to the production function. If any of them increased, the curve would shift upward.

Distinguish between the marginal product and total product.

The marginal product of HC is the increment in HS from a 1 unit increase in HC.

Note the *Law of diminishing marginal product*

If we were currently at n - HC has made a large total contribution to HS - AP is high, but the marginal product will be quite low. Additional expenditures on HC will not impact health

The MP is probably the most relevant for policy!!

Curve could eventually reach a point where MP negative - over use of medical care - lots of unneeded surgery etc.

Historical Role of Medicine and Health Care.

Most agree that medicine has played a relatively minor role historically in the rise in the population over the past few hundred years. If you look at major causes of death (Measles, scarlet fever, TB, typhoid, etc.) it turns out that the vaccine/drug came out after the death rate had already declined substantially suggesting that something other than the drug itself increased health. Reduction in exposure and better knowledge of the disease seem to have played huge roles. Public health is important here, but note that much of this information came from the medical research into finding the vaccines. So Medicine's role is probably understated by simply looking at the effect of the drug on death rates.

Measuring the Production of Health

Note that before we can measure the production, we first have to figure how to measure health.

Mortality vs morbidity

Difficulties of non-experimental data.

The following table is taken from Cutler, Lleras-Murney, and Vogl, "Socioeconomic Status and Health: Dimensions and Mechanisms" NBER working paper 14333, September 2008.

Table 1: Socioeconomic Status and Health, NHIS 1990, Ages 25-64

	10-Year Mortality					Fair/Poor Self-Reported Health				
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Education</i>										
Years of Education	-0.33 [0.03]**	-0.18 [0.04]**	-0.11 [0.04]**	-0.17 [0.04]**	-0.18 [0.04]**	-1.45 [0.06]**	-0.82 [0.06]**	-0.66 [0.05]**	-0.82 [0.06]**	-0.77 [0.05]**
<i>Household Income (Ref. < \$15,000)</i>										
\$15,000 - \$24,999	-0.95 [0.27]**	-0.48 [0.26]	-0.31 [0.25]	-0.46 [0.27]	-0.45 [0.26]	-2.58 [0.40]**	-1.31 [0.36]**	-1.1 [0.34]**	-1.31 [0.36]**	-1.04 [0.33]**
\$25,000 - \$49,999	-2.17 [0.25]**	-1.25 [0.26]**	-0.89 [0.24]**	-1.22 [0.26]**	-1.21 [0.26]**	-7.18 [0.39]**	-3.82 [0.37]**	-3.2 [0.35]**	-3.82 [0.37]**	-3.32 [0.34]**
≥ \$50,000	-2.96 [0.32]**	-1.66 [0.33]**	-1.17 [0.31]**	-1.64 [0.33]**	-1.63 [0.33]**	-11.94 [0.54]**	-6.15 [0.54]**	-5.2 [0.52]**	-6.15 [0.53]**	-5.56 [0.50]**
<i>Occupation (Ref. Managerial & Professional)</i>										
Tech., Sales, Admin. Support	-0.01 [0.33]	-0.53 [0.35]	-0.65 [0.33]*	-0.54 [0.35]	-0.49 [0.35]	3.02 [0.63]**	0.67 [0.57]	0.5 [0.54]	0.67 [0.57]	0.86 [0.53]
Service	0.77 [0.32]**	-0.29 [0.34]	-0.51 [0.31]	-0.32 [0.34]	-0.22 [0.33]	6.16 [0.56]**	1.36 [0.55]*	0.93 [0.51]	1.36 [0.55]*	1.71 [0.50]**
Operators, Fabricators, Laborers	1.18 [0.38]**	0.02 [0.40]	-0.38 [0.37]	-0.02 [0.40]	-0.10 [0.20]	6.82 [0.64]**	1.6 [0.62]*	0.99 [0.58]	1.6 [0.62]*	2.01 [0.58]**
Out of labor force	3.26 [0.31]**	2.01 [0.32]**	1.55 [0.29]**	2.00 [0.32]**	2.03 [0.31]**	12.93 [0.52]**	7.29 [0.52]**	6.5 [0.49]**	7.29 [0.52]**	7.11 [0.48]**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
<i>Race/ethnicity (Ref. Non-Hispanic White)</i>										
Non-Hispanic Black	1.47 [0.29]**	0.67 [0.29]*	0.95 [0.27]**	0.66 [0.29]**	0.71 [0.29]*	5.5 [0.47]**	2.28 [0.39]**	2.34 [0.38]**	2.28 [0.40]**	2.53 [0.37]**
Hispanic	0.88 [0.42]*	-0.06 [0.42]	0.40 [0.39]	-0.06 [0.41]	-0.01 [0.41]	4.29 [0.64]**	-0.58 [0.57]	0.08 [0.53]	-0.57 [0.57]	0.06 [0.52]
<i>Controls for:</i>										
Demographic Variables	X	X	X	X	X	X	X	X	X	X
Other SES Variables		X	X	X	X		X	X	X	X
Behavioral Variables			X					X		
Knowledge Variables				X					X	
Stress Variables					X					X
Observations	25,752	25,752	25,752	25,752	25,752	25,894	25,894	25,894	25,894	25,894

Notes: The estimates represent marginal effects from logit estimations, evaluated at the means of the independent variables. All estimates are multiplied by 100, in order to reflect marginal effects in percentage points. Brackets contain robust standard errors. * p = 0.05, ** p = 0.01. Mean 10-year mortality is 5.59%, and mean fair/poor health is 9.22%. Demographic variables include age, sex, region, size of metropolitan area, marital status, and family size. Behavioral variables include current smoker, ever smoker, number of cigarettes per day, obesity, regular exercise, and use of a seat-belt always. Knowledge variables include the number of correct responses to health questions about smoking, drinking, and heart disease, with one tally for each of these three domains. Stress variables include self-reports of "a lot of stress" over the past week and over the past year. The race specifications also include a dummy for "other" race.

Conclusions from research:

- Education has a strong relationship at all age levels, but it is smaller for older adults
- Income has a strong effect for low income but tapers off as income increases. The effect becomes steeper with age
- At all ages nonhispanic blacks have higher mortality/SRHS than nonhispanic white. The gap widens with age
- Hispanics have higher mortality rates than nonshipanics at low age, but lower at older ages. SRHS shows Hispanics worse than whites at all ages (this goes away when controlling for income and education)
- Some of the income and education effects go away when control for demographic characteristics (age, sex, region, city size, marital status, family size). Even more when behavioral variables are added (smoker, obesity, exercise, seat belt use)
- Reverse causation with both Education and Wealth?

1. Grossman

better educated people understand the technology or know-how needed to stay healthy. If this were true then a transfer of funds out of medical care into education would greatly improve health. That is expenditures on health would yield the MP from production fcn studies.

2. Fuchs

Self selection problem. People who choose higher education also more healthy people with low discount rates tend to have higher education since they are patient. Similar thing is happening with their stock of health. May be willing to give up unhealthy activities today in return for an increased life span. Likewise those who do not obtain a lot of education are impatient - they want it now. Thus, they are less likely to choose a healthy lifestyle - more likely to drink, smoke, eat onion rings, etc. The implication is that increased expenditure into education will not improve health much.

Income effect could go both ways as well.
Evidence of short run vs. long run differences.

Short run shocks to wealth – recessions tend to increase health, expansions tend to decrease health. Longer run effect tends to be slight positive.

For children income has a strong causal effect – even controlling for insurance, education and everything else you can think of.

THE DEMAND FOR HEALTH CAPITAL

1. Conceptual Framework

Grossman adapted human capital theory to explain the demand for health and health care. His theory demonstrates how health demand is different from other goods:

1. Not medical care per se that consumers want but health

2. The consumer does not passively purchase health but produces it - medical care demand is a derived demand for an input to produce health itself. People want health and they demand medical care to produce it (along with lots of other things)

3. Health last for more than one period. It is a durable good. Thus it is a time allocation problem.

4. The demand for health has two aspects:
 1. Pure consumption aspect - health is desired because it makes people feel better
 2. Pure investment aspect - health is desired because it increases the number of health days available to work and thus increases income.

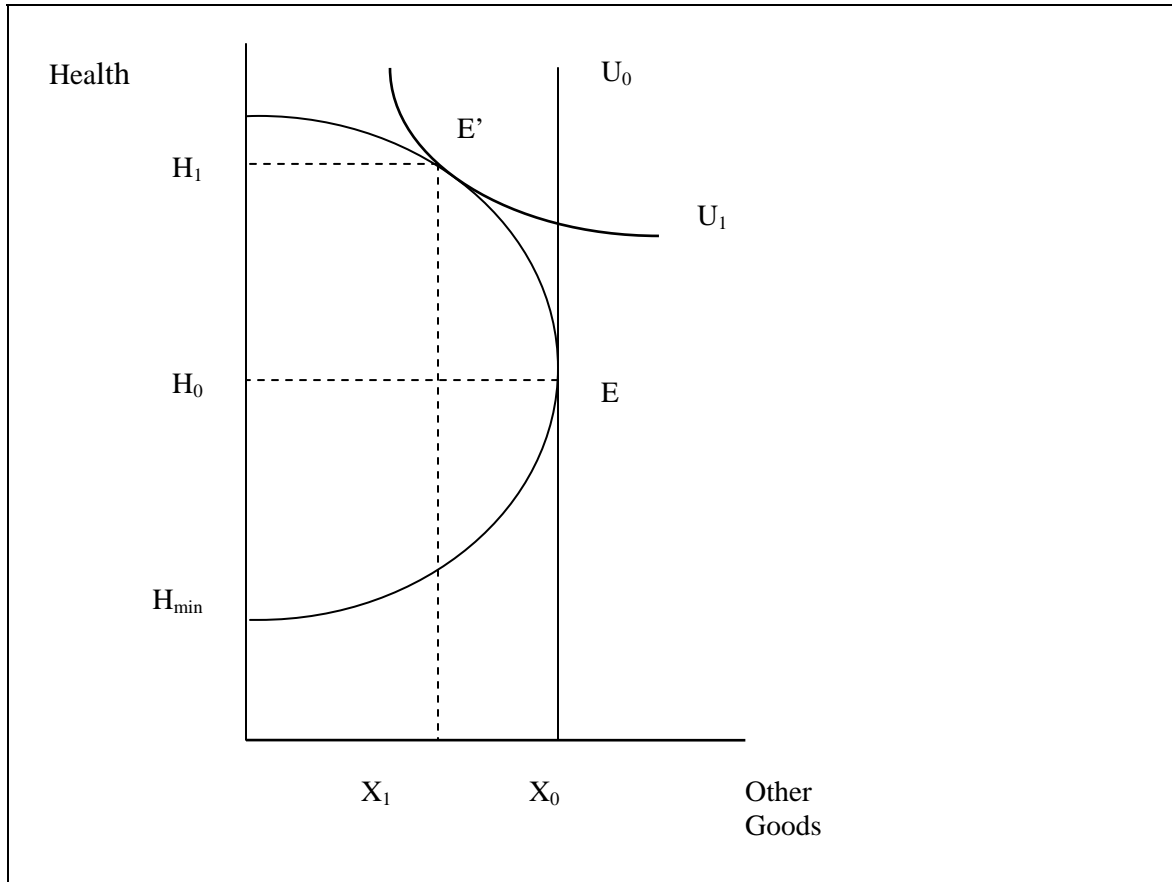
5. The Demand for health is uncertain. The idea is that unlike other goods, we really do not know what our demand will be like in the future. This adds to the mix, because we need to allow this uncertainty or risk to affect preferences. This gives rise to the market for health insurance, and also leads to many of the problems in health care markets.

First we will deal with demand with certainty to see how the consumer choice model plays in here, and then we will add the complication of uncertainty later.

2. The production of health

Now lets talk more about how health is produced. Consider the following production possibility frontier for an individual consumer

The Production Possibility Frontier



Note that it is shaped a little differently than from what you've seen earlier.

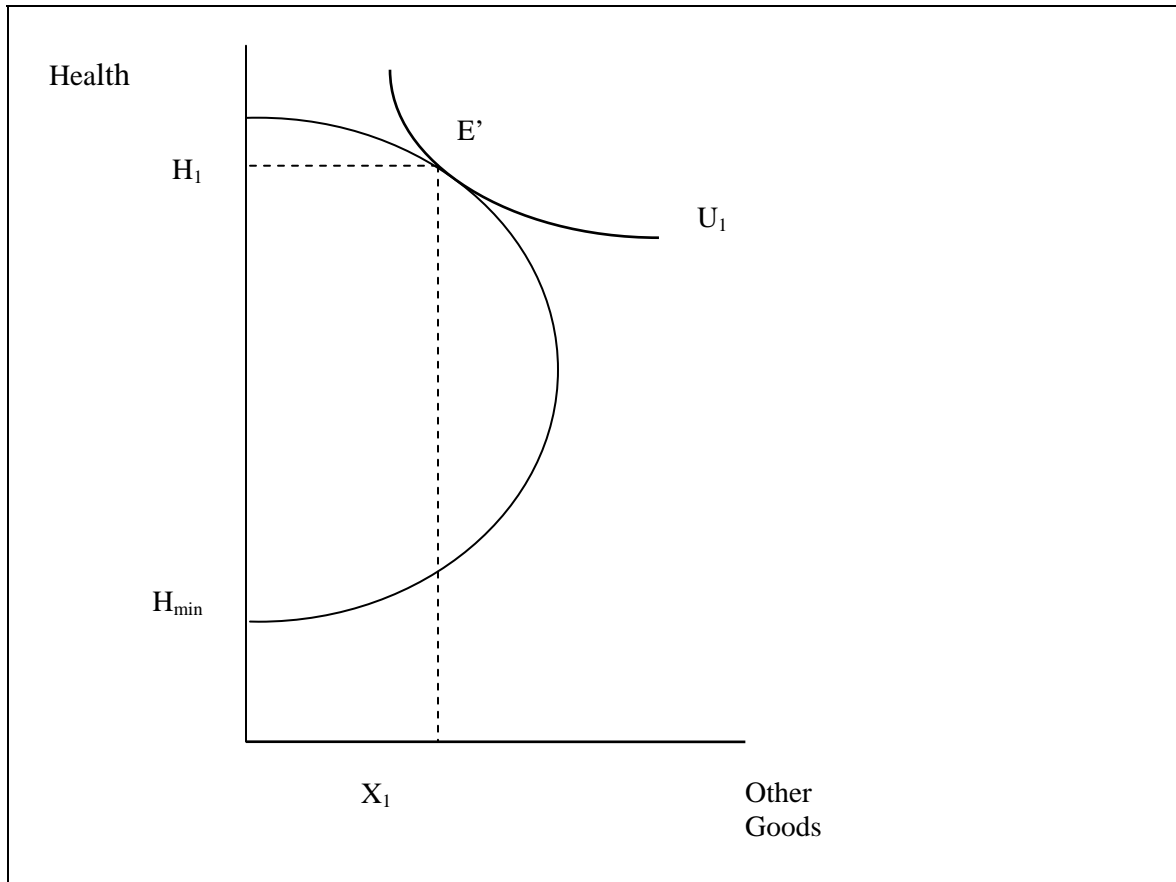
1. H_{\min} – need at least this much to live
2. Upward sloping between H_{\min} and E Initially improvements in health also increase consumption of the other good. This reflects the investment effect. Once past point E though, additional increases to health come at the cost of reduced consumption of the other good.

If the consumer only puts value on health to the extent it allows him/her to consume other goods (health in and of itself does not provide utility) then the indifference curve will be shaped as in U_0 and the equilibrium will be at point E , with X_0 of the other good and H_0 in health. But if the consumer placed some consumption value directly on health (it feels good to feel good!), then the indifference curves might be shaped something like U_1 . Then we'd get some additional investment in health beyond H_0 to H_1 .

THE DEMAND FOR HEALTHCARE.

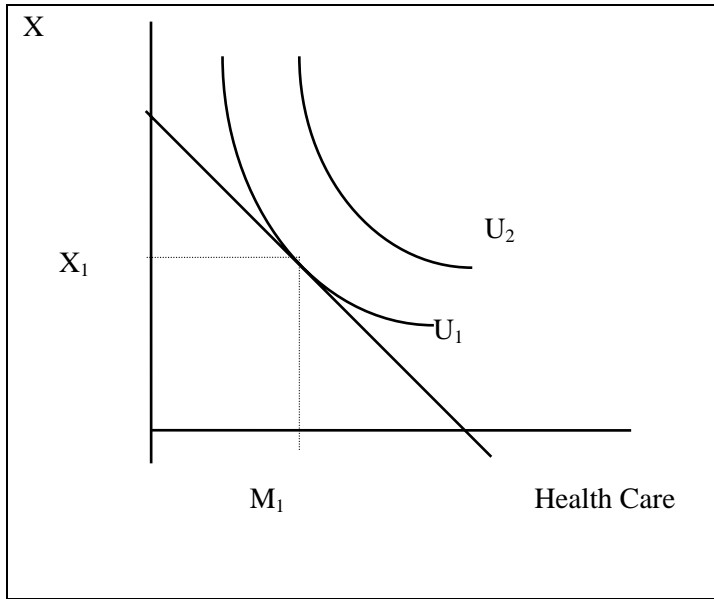
Now we want to go from the production of health decision to the demand for health care. We will then use that to describe how the demand for insurance affects that demand and how markets have attempted to alleviate that problem.

Recall the production possibilities graph:



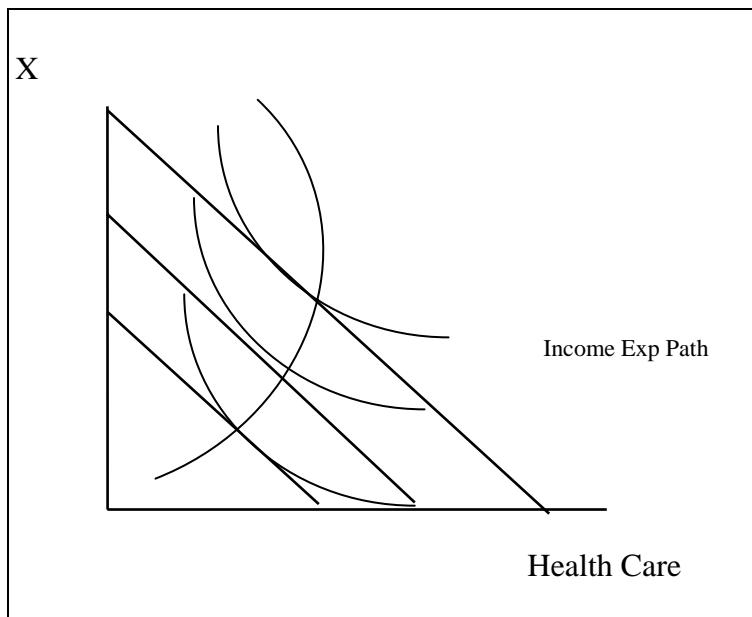
This yields some optimal level of health, H_1 . Once this is chosen the consumer must “produce” this amount of health by using, among other inputs, health care.

The PPF shows feasible sets of X and health that we can attain (as individuals) given our production process and our budget and the utility derived from various combinations of X and H . Underlying this is some production process one of the inputs into this is health care. Thus we can derive a similar graph for X and health care that looks more familiar to us.



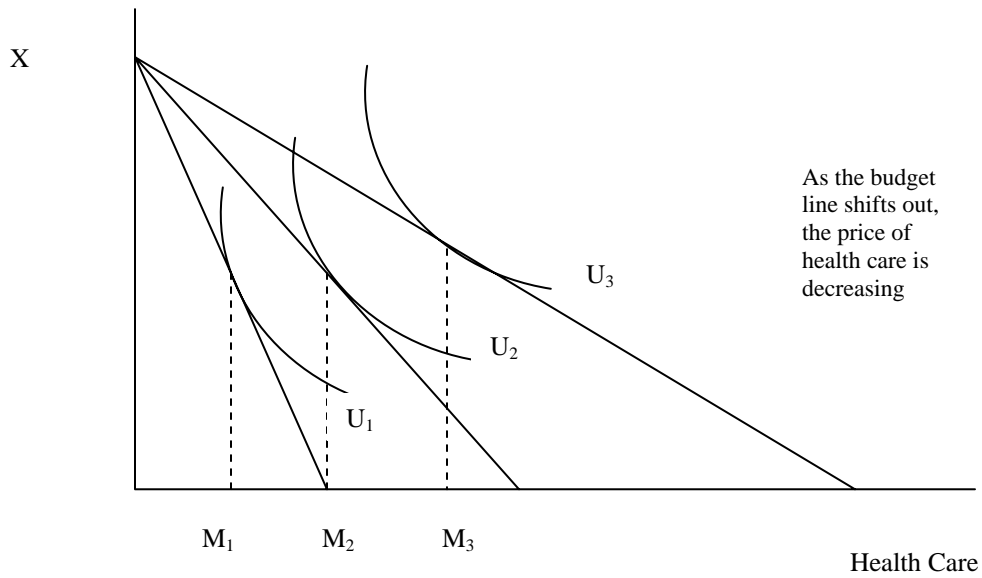
Here the budget line shows the affordable possibilities for the consumer to spend his/her income between X and health care (say visits to the doctor). The shape of the indifference curve here is determined by the patient's willingness to trade off X for visits to the doctor (which is determined by her/his ability to produce health with these visits). The equilibrium level of health, H_1 , corresponds to the equilibrium level of health care, M_1 , in this graph.

What happens as income increases?

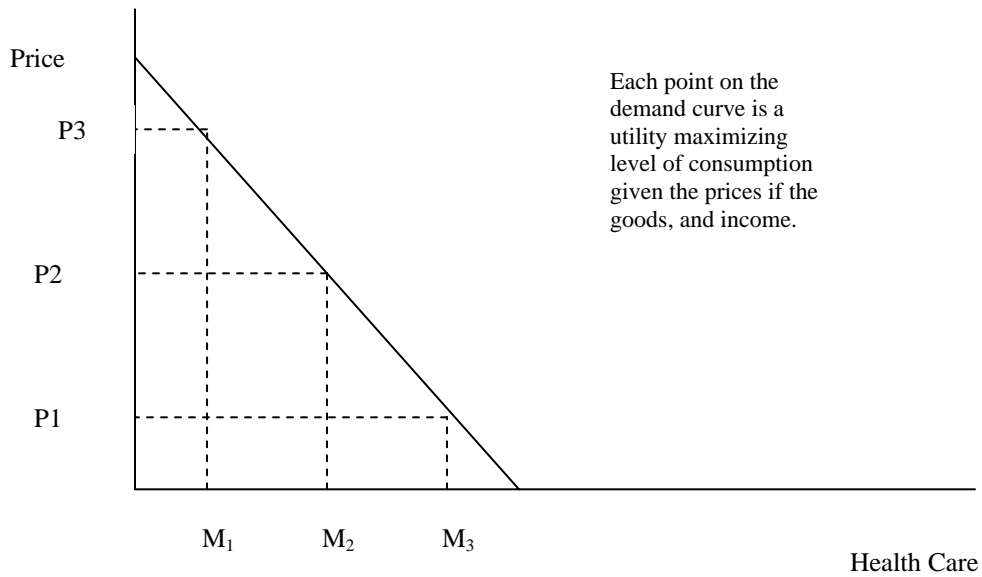


Sanitation Effect - initially
Health Spa effect - increased income results in a change in lifestyle - can afford to pamper yourself
Life in the fast lane - increased risk taking - driving bungee jumping etc.

The demand for health care is from this utility maximization problem. How does the optimal level of health care demanded change as the price of health care changes?.



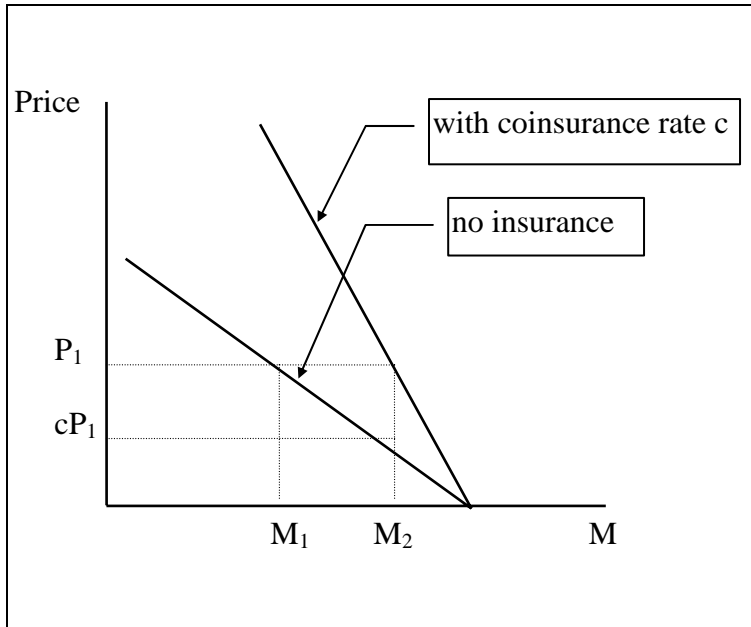
The demand for Health Care”



Coinsurance

Often consumers are covered by health insurance. Typically coinsurance refers to the percentage paid by the patient while co-payment refers to the amount paid by the patient.

Individual effect

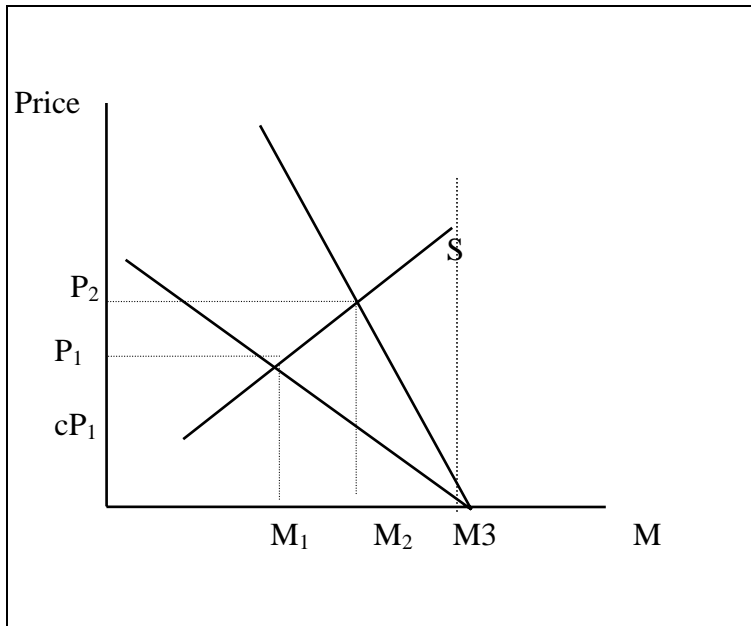


With insurance the demand becomes more elastic

Without insurance, if the price was P_1 then consumers would demand M_1 . But with insurance they consume M_2 . It is as if the price fell to cP_1 .

The more generous coverage (or the lower the coinsurance rate) the steeper the demand curve become until it becomes vertical at $c=0$. Critical feature here is that coinsurance makes the demand less elastic.

Note the effect on the market



The effect of insurance on the market is to rotate out the demand. Assuming an upward sloping then that increases Medicare care from m_1 to m_2 and increases price to p_2 . Thus expenditures in health care increase from $p_1 \cdot m_1$ to $P_2 \cdot m_2$. This is a major factor in the increase in medical expenditures over the last 40 years. At least according to some.

This response to the economic incentives is termed **Moral Hazard** – the increased usage of services when the pooling of risks leads to decreased marginal costs for the services. It is also

used to refer to the change in behavior that may occur when risk is reduced – driving more dangerously because of insurance and seat belts, FDIC.

Note that the more inelastic the demand for health is the less this loss will be. Also the use of coinsurance rates reduces this. Note that in the absence of c the consumption would be M^3 .

4. Empirical measurements of demand elasticities

A. Price Elasticities most estimates are inelastic when they look at market elasticity. These tend to be estimated in the $-.05$ to $-.2$ range for hospital services
 $-.15$ to $-.3$ for physician visits.

Pretty inelastic.

However when *Firm Elasticity* is considered we get a different story:

Physician Services using physician price or visits: -3.0 to -5.7

Hospital services patient days or admissions: $-.74$ to $-.80$

Note the contrast = suggests that market for physicians is quite competitive while there is considerable market power in the market for hospital services.

B. Income Elasticities : Generally quite small, but positive. More income causes a slight increase in health care.