

Economics of Health and Healthcare
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Lecture - 21
Grossman's Demand Model

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$y = a + bx$
 $\text{logit} \Rightarrow \ln \left[\frac{Pr(x)}{1 - Pr(x)} \right]$
 $\text{Odds} \rightarrow e^{a+bx}$
 $\text{odds ratio} \Rightarrow \frac{\text{odds}[x+1]}{\text{odds}[x]}$
Contingency Matrix : $\begin{bmatrix} a & b \\ c & d \end{bmatrix}$
 $\text{odds ratio} = \frac{a/b}{c/d} = \frac{ad}{bc}$

Now we will take you to the Grossman's model which you know mainly talks about that health when we started our discussion, our Grossman's model discusses mainly the health is being produced by the individuals and you know health is now estimated in terms of health stock yeah.

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health \Rightarrow health stock

Investment

① Consumption effects :

② Investment effects :

Health as a capital good :

$$\text{Health Stock (HS}_t) = \text{HS}_{t-1} - \delta + \text{inv. in HS}_t$$

So health is health stock and being produced by the individuals you know and when we estimate the health and health stock we actually you know graphically we can represent that but we are thinking in terms of you know investment towards health stock. Why do people invest on health stock that is primarily because they want better health you know so and once they have better health that actually results into the better productivity.

And better productivity is higher income so they can actually you know gain more and more through that higher income, but this investment when we are doing a Grossman model we have to keep in mind that this model or this framework defers from different socio-economic background so you need to keep in mind the work environment, the employment status, the education, the income and all these things.

And then we have to give relative importance to the inequalities existing in that particular society. So we cannot really take a particular society altogether and then estimate a Grossman's model and when that we are utilizing the idea of that health as a producer we are not basically taking the traditional demand analysis and this you know the producer of the health is not simply a consumer it is also coming from the health care producers.

So when we are thinking of this you know the investment then we also need to think that we could invest in some other areas you know, not investing for health we could probably buy a TV, buy a car or something else which I am actually gaining but like if I am buying a car I am utilizing that, I am buying a TV I am utilizing that. So that is not actually the opportunity cost.

Because not investing in health I am investing in something else the consumption goods, but what happens if I do not invest in something else I keep the money in the bank I am getting some interest rate so that is the real loss. At the same time, I am also you know losing something in terms of the depreciation because every investment has a depreciation anyways. So when we are thinking of this you know investment and also we must keep what is my interest rate loss in terms of interest rate as well as what is my lost in terms of depreciation.

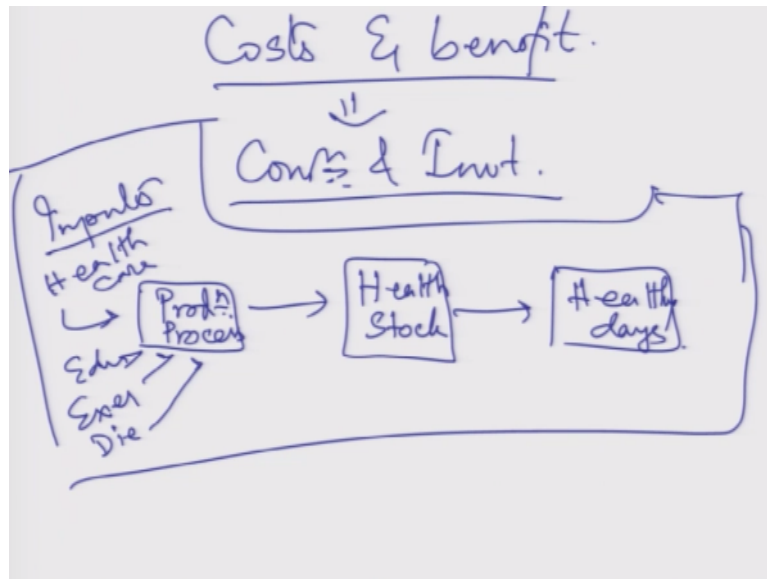
So individuals value health, but they do not actually want to lose every consumption so there is always a trade-off between the health as well as the consumption and every investment has 2 effects. They do not only invest to get a return, but they also invest in terms of consumption because one is consumption effects which gives you or which gives an individual a better feeling, a better satisfaction when they are healthier.

At the same time investment effects this is giving them a better health which they use to earn more you know to stay healthy and to be more productive and again to be more productive, be more income or more other affordability to have better health and better consumption of other goods. So when we take health as a human capital good to improve the human health, health as a capital good then we estimate the health stock.

If I can call it HSt at time period t will be dependent upon the previous this thing as well as the depreciation of the health, sorry it should be minus, the depreciation as well as the investment in health stock in time period t . So this health stock in time period t will be dependent, it has a time effect, will be dependent on the previous time period, the depreciation as well as the investment I am making to improve my health t .

And this health depreciation or health production both will be dependent completely upon the efficiency of mine. So of the individual who is investing on the health. So both of this consumption sorry the satisfaction as well as the investment or the consumption effect as well as the investment effect will depend upon the consumption.

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And benefit right, so both you know costs and benefit both costs and benefit out of the consumption and investment. So and they will do an analysis of this cost and benefit and they will decide whether they will go for this investment or not. So in terms of the production process if I am producing my health in terms of this production process there are plenty of factors right and this inputs are not only health care, but also education, exercise, diet, income and all this.

And this final produce through a production process it will produce my health stock together, it is not only the way that I go to a doctor whether or not and then this will lead to how many days I live healthy yes. If this is the production process given by Grossman, then we can actually think of a 2 different models where in one model we take health as health production.

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Health prodⁿ

$$\begin{cases} I = f(\text{inputs}, T_H, E) \\ C = f(X, T_C, E) \end{cases}$$

Marginal Benefit : rate of return

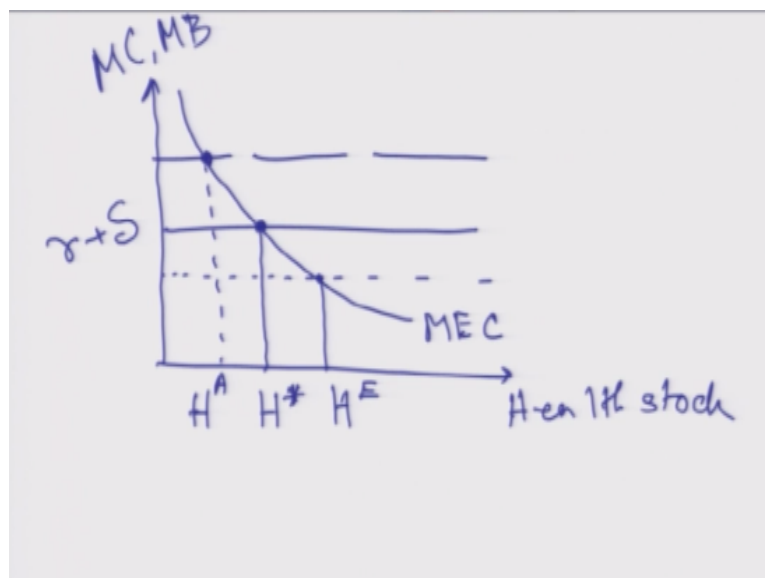
$$= \frac{W \times Q}{C}$$

Where you know my health production or it is my investment right whenever we are talking about the production is the function of you know inputs, my time I spent on health as well as my education. We can take education as the proxy of the income as well and in terms of consumption we can take different consumption elements you know we are spending time for different other consumption activities going for gym, not going for gym and education.

So these are the 2 models we assume that education can be an important indicator in determining the you know investment level or it is outcome. So and after this these are the in terms of the cost if we are looking at the marginal benefit then this marginal benefit will give me a rate of return, where this rate of return will be estimated by W which is the wage into G divided by C . G is the marginal product of health investments you know.

So it will be W which is wage into G divided by the consumption direct I mean direct cost in terms of investment in health.

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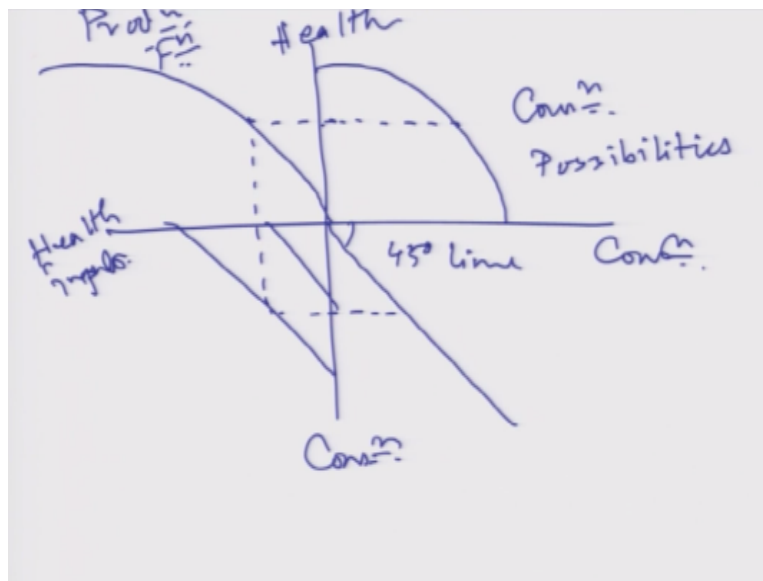
So if we plot them together in Grossman's model then we find that the cost will remain constant you know this is my health stock, the cost will remain constant and my real cost as I said is the interest rate as well as the depreciation interest rate what I could have earned this is the opportunity cost if I could keep the money in the bank and this is my marginal efficiency of you know capital which I have invested and this can be marginal cost and marginal benefit.

So this is my basically marginal benefit curve you know and then a person will have the optimal health stock over here this marginal efficiency of the capital curve goes down

because of the diminishing returns to scale and this particular point they will have a better health stock when they have higher income so their health stock will be more with higher education or higher income.

If they have higher age their health stock will be lesser. So it has direct implication of age, education as well as income and once we put them in a you know in a four quadrant diagram we can draw it like.

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We can draw it like over here health, your consumption, over here consumption and here health inputs. This is my production function, this is my consumption possibilities and this are my budget constraints, yes and I can estimate my amount of health input and health and this is a 45 degree line consumption and consumption 45 degree line. This is my production function and this is my consumption possibilities.

So this Grossman's model has a direct implication when how I am using my you know my background variables to produce my health stock and how I am not using and how it differs from different socio-economic behavior. So you know it is extremely useful to design the policy frameworks; however, it has got some criticisms is one it ignores the insurance models, the other it is like it has a constant investment over life term.

Over the life term, over the age the income differs and the investment differs so we cannot really take it as a consumption at the same time it assumes there is a perfect information when people have education they have perfect information and the health stock is better

because they are using the utilization. If they are utilizing their education, the information at the most so that is not that case most often and it is too deterministic in terms of the choices to make in terms of health stock. Thank you.