Health Economics

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Week – 02

Lecture – 06 Utility and Health

Welcome, friends, once again to this NPTEL module on Health Economics. This is one of the unique courses in economics. This is usually considered as an elective course. However, depending on your choice, you can consider this core and elective. We conceptualized this module in 12 weeks, and this is our second week of the module. We have thought of defining the demand in healthcare.

We observed the differences in different articles, and based on readings of various books and articles; we captured five important topics for discussion under this topic. Therefore, our first lecture is on utility and health. As we know, health is hard to measure; a person's health is not considered or conceived to be the best unless we do not define the utility of consumption from various goods. Therefore, utility and health have a huge relationship; hence, we can define our next lecture on the demand for healthcare in detail.

And accordingly, we will emphasize the modules on demand for healthcare. Some of the important learning goals we have set here are as follows. How do we get utility from our health? How do we change our preferences for consumption with changes in health? Also, we will discuss the production function of health, with special emphasis on medical care, disease and consumption, and other goods. How do other goods, as a function of health or health along with other goods, define the best utility to the consumer? Since we are discussing the production function of health, we will emphasize how far health production is based on the demand derived through medical care products.

The last of these objectives is identifying the effects of different choices, especially our lifestyle choices. As you know, in the present time, with the complexity of consumption, we are juxtaposed with so many options, so many quick consumption bundles by which a person is eventually attached to some of the habits, some of the lifestyle choices that may derive bad health outcomes. Along with some basket of commodities, in reality, available which derive positive outcomes. Therefore, how a person is in a life cycle is balancing their life is the most important challenge. Therefore, since complexities exist, we have different models to explain and deal with those complexities. To start with, health is good in the sense of good or bad.

An economic good increases a person's utility, while the bad decreases its utility or the person's utility. How do we think of health, good or bad? We can cite some examples and clarify. Here we are saying which of us enjoy getting weekly allergy injections or once-in-a-lifetime shots of yellow fever and hepatitis. Do you like it when your dentist drills into a molar in your teeth? Do you like medicine pills, etc.? What kind of reaction functions exist with consumers when we consume such products? Based on that, we prefer to go for some of the consumption baskets.

In a market where we pay for these above services, these healthcare services cannot be considered good when we are supposed to be treated as a bad outcome of that consumption. These economically bad products usually hurt the consumer and do not augment utility directly. Sometimes, they even have harmful side effects as well. It sounds like a bad rather than a good commodity. What does create more utility for an individual? It adds happiness, and as a consumer, you enjoy and feel healthy out of your consumption, which is called economic goods.

The flow of services produced by the stock of health creates a flow of utility. However, for simplicity, we can say that a stock of health adds utility. In short, health is a stock variable. For a person carrying a certain degree of health, how far those stock variables add value or depreciate with value depends upon your consumption choice and other environmental factors. Living humans have an inherent stock of health.

A normal, healthy baby has a relatively high stock of health. The like substance is measured at birth, and later on, it declines with a rise in age. An infant born prematurely with lung disease, the risk of brain damage and possible blindness has a very low initial stock of health. Almost every action we take for the rest of our lives affects our health stock. Therefore, the stock of health we are inborn with, we are blessed with, may not be kept as with that level of value in different walks of our life or different stages.

Hence, preference matters, and change in preference with health matters. We start with an example at this moment. Pragya likes ice cream very much; she prefers ice cream over healthy food prepared at home on any typical day. We start with ice cream as an example. One day, she got drenched in the rain, returning from school.

She fell ill and caught the fever. Would she still enjoy ice cream more than home-cooked food in her new state of sickness? We are comparing ice cream to home-cooked food, considered relatively healthy. If your answer is no, then what has changed? People change their preferences with the change in the state of health. Therefore, our next set of explanations will be health state dependence. That is our health state dependence, and we will clarify them one by one.

If an individual has a stock of health that we are mentioning here as H for your clarity and consumes all other goods that are noted here as X, let us call with a bundle U as a function of, or you can write down U as a function of X and H, i.e., $U(X, H)$. X stands for all other basket of commodities. You are carrying a stock of health H. To clarify our utility function further, we will explain two important concepts in health economics: health state dependence and health state independence. When the shape of the utility function varies with health, it is called health state dependence. When it is independent, when the shape of the utility function does not change with health, that is called health independence.

We have some references where different experts, faculties, and professors have explained the health functions by considering other goods (X) and health stock (H) as variables and how they are presented. Sometimes, you will find H, a binary health variable. In some cases, you will find that it is in multiplicative form with the X function. In other cases, you will find an expected number of life years, and in the last one by Finkelstein in 2008 paper, especially we will be referring to more of her work where the expected utility function is greatly explained. We will be emphasizing the health state variable in detail.

Therefore, our set of explanations will emphasize this more. You can read we have also given the year of their publication as well. Let us talk about the utility function and healthcare. Here, the health function is presented with the different set of other goods consumption. With the rise in consumption, our health function is obviously considered to be different and it is considered to be upward sloping, U as a function of X.

In this case, we say in our function, H_2 is greater than that of H_1. But please remember that we have already said this is a direct relationship between X and utility, but with the assumption that H is considered to be constant and more consumption of other goods gives you more utility. Monotonocity of preference is not emphasized at the moment. We are trying to identify the relationship, and we will clarify what happens when our consumption basket goes with more good and bad commodities. As a typical microeconomics model, we can also present health and other commodities as a basket of commodities in our bundle. The choice function can be explained from our relationship between U and X, $U(H, X)$.

If you remember very well, the indifference function or purpose is to identify which combination of the bundle of commodities that give the best level of satisfaction to the consumer. Indifference curve states that all combination of products on the same utilities basket or on the utility map on the same indifference curve is considered to derive equal level of satisfaction. You can read between the lines we have mentioned here very well.

The point (X_1, H_2) is equivalent to a point (X_2, H_1). We are compromising since we must look at our resources given our budget.

The level of healthcare and if you are efforting more on other consumption, you cannot able to spend more on healthcare products. Maybe healthcare products, you are investing in healthcare-related products, maybe for gym, maybe related to good quality food, which is directly connected to health. Of course, we are considering that when X commodities as well, but here X is combining with all sorts of products that are directly connected with the health basket or medical-related products etcetera. Either you are extending more of X at the cost of this one or vice versa. When you have a higher budget, you will shift your choice function or the level of satisfaction to higher point.

That is why it is highlighted with (X_2, H_2) which is reflected in a higher level of satisfaction to the consumer. What do you mean by health state dependence? We have already said as a function of healthcare, here I have already mentioned, once again I am just clarifying it with you. When your utility function vary with health, change with health, basically you are having certain level of dependence with a choice functions. Accordingly as a consumer, as a member in the household, we are supposed to allocate the products accordingly for the best-desired results. Health state dependence, especially we are referring to the Finkelstein et. al. (2009).

In short, we are mentioning HSD, health state dependence, which has analyzed the effect of health on non-medical consumption. There are two signs of health dependence we will be emphasizing in detail. One is called negative health dependence, and another is called positive health dependence. And what is this? Let us start with the negative health dependence. The negative one is where the marginal utility of your consumption could decline with deteriorating health.

When your marginal utility actually declines or could decline with the deteriorating health conditions or marginal consumption rate increases with increasing health as many consumption goods such as travel or like any other complements of good health. With health, it declines; other consumption helps increase the case. Coming to positive health dependence explains that the marginal utility of consumption could increase with deteriorating health; that is called positive state dependence or marginal utility of consumption decreases with increasing health as other consumption goods such as prepared meals or assistance with self-care, may substitute of other health. We will clarify all sort of things here. Once again, there are negative and positive health state dependence.

We are emphasizing the paper by Finkelstein et al. (2008). The source is also referred to here. First, we have highlighted that our utility function is positively linked with your

consumption basket. We refer to consumption as X, which we have already mentioned. To emphasize further, we have cited two real cases.

One is called a hospital visit, and another is called a nursing facility at home. The first diagram is related to hospital visits. The second one is nursing facilities at home, let it be. In the first case, it is called negative health state dependence.
I will clarify why. The relationship between the change and the marginal change in the utility basket with respect to the consumption declines or with a level of sickness declines. How is it so? First, we clarify that your utility function for good health, its elasticities are different, and your changes or slopes are very different. You mark this difference very clearly. This is utility when in good health, you are spending in good health. Whereas the utility when you are spending, when you are in poor health, like your utility you derive, a person derives when the person spending in different commodities, which I just said, yes, it matters, but depends upon which kind of commodity you are spending and also depends upon which state you are in, which health conditions you are in.

If you are carrying with a good health, the same basket might be replaced with different utilities. If you are carrying a bad state, your reactions or the derived utility might differ. That is why it is very research version. For your clarity, we have cited two examples.

One is called a hospital visit. In the caption, we have mentioned sickness; in both cases with sickness, the person is in good health. In that case, the incremental change in utility for the person with good health increases better than that of the person already in bad health when the person must consult healthcare from an institutional facility. The gap increases. This gap initially is this, and the gap between these two is much higher. And when I am in good health, it is quite obvious that I would prefer to consult my diseases in a certified hospital, and I will directly meet there. Even on the way, I will enjoy my movement.

Therefore, when marginal utility is actually, though marginal utility in good health increases whereas bad health declines differently, in both cases marginal utility declines, the rate of change declines, but the net gap is the crux here to explain the health state dependence. The net change is looked at as the change with respect to the consumption. This is inversely related. For the marginal change, we have highlighted the gap increases; this change is higher, whereas the gap increases, and therefore, we say that the marginal utility derives with sickness declines. When you are carrying a certain sickness, your marginal utility declines.

In another case, in panel B, we are referring to nursing facility. In the case of nursing facility, sickness is really a bit contrast. The marginal utility, in that case, you are carrying with bad health. We are referring to sickness as a state, emphasizing sickness. If

you are comparing it with just consumption, you might be confused, but sickness if it is your state of health, then your choice function for healthcare or for any other basket of commodities is reflected differently.

In that case, when you are carrying a sickness, and somebody is facilitating you in your home, your marginal utility increases. When your utility functions, the change is quite visible, that gap decreases. In that case, with good health, somebody will not prefer to get it served in home in case B. But if you are carrying with sickness or with bad health, obvious will prefer that somebody should provide to a bad or within your home. What we wanted to means that health state dependence in this case increases.

What is this all about? The health state is not the same for all the cases. That might be different in economic goods, and there might be healthcare goods that might be different as well. Broadly, we are defining two types of healthcare goods here. One is called which is called negative health state dependence, and the other is called positive health dependence.

In short, it is a function of sickness. Given your state of health sickness, then your choice function are different. In one case, it increases. In another case, it decreases. You can further validate with another easy example. You can plot it on your own with this kind of example. Here we have tried to identify negative health state dependence.

We started with marginal utility when somebody is sick and the marginal utility when somebody is healthy with a different basket of communities. For in short, we have cited only six baskets. Marginal utility to start will be higher in case somebody is carrying good health. Yes, the incremental change we have highlighted is equal amount. However, in the total health case, you will find a major change, the gap increases.

In the marginal case, the health state dependence will be different in the healthy as well as unhealthy cases. In total utility cases also the gap increases. That is emphasized in our previous slide as well. The marginal utility of consumption increases with health that basically called negative health state dependence. And if the difference in utility increases with consumption, we refer to the phenomenon is called negative health state dependence.

When the difference or the gap increases, that is precisely called negative health dependent and that is a serious concern in our healthcare products, what to be produced, what to be supplied in the market, how it should be catering to the patients. That is one of the core issues you can take up in your research, or you can take up in your internship wherever you are pursuing will be very helpful. Hence, negative health dependence is clarified with marginal utility of consumption increases with health whereas in second case, marginal utility of consumption decreases with sickness. Your consumption

decreases with sickness which we have highlighted in our diagram. Both the cases are cited in the case of health state dependence.

The negative state dependence can also be validated with the equation simply. First you check with the first order derivative $\frac{du}{dx}$, then you check with your$\frac{d}{dh}$ with the cross-sectional changes with these. This is with respect to your marginal utility as simple. Whereas, when you compare with your health changes, start with a health, what happens when health is different, you compare with respect to health, you will find the change. When it is rising, the gap increases with respect to health that is precisely called negative health dependence.

It seems to be a different contrast. It might come as if it had been less than 0 would have been negative, it is not the case. We have taken H here, is your second-order derivative. In that case, when the gap increases with a state health state H that is called negative health dependence. statement all three are explaining is the negative health dependence. Whereas just the reverse is true, we have highlighted in this case.

You can refer in panel B that was valid in a panel B case. Come to some of the examples, you will also get other examples in your assignment. I am sure assignment will be very good for you to clarify things better. At this moment, we have given some models, some equations, functional forms of healthcare where we have taken health with other commodities. You can identify which one is called positive health state dependence and which one is called negative health dependence. First of all, in this case, what you can do? And this is your equation, you can simply take first order derivative d by dx here. Therefore, of this function u, then it is $\frac{d(a+bh)X}{dx}$, isn't it? When you take the first order derivative of this, the result will be$(a + bh)$, you cross-check with your class 12th-level derivative functions, and then this is the first change we have obtained. The crux is here, you are supposed to take the health state, we are not just supposed to take with respect to the consumption. If you are taking consumption, you are explaining precisely your utility function which the standard microeconomics theory emphasize. But here in health economics, we are supposed to attach or connote with health state. So, the next function should be equal to $\frac{d}{dh}$ of $(a + bh)$.

You will find 'b' is the answer, in this case, '+b' is the answer. So, 'b', usually we considered as a positive coefficient. It is positive, as simple as if 'b' is positive. When it is positive, what is the answer? You can easily guess. This clearly explains that we are going by this example or this model explains negative health dependence.

Similarly, you can easily clarify all other examples. We start with health to categorize whether person starts with a good health as 1 as a binary indicator or start with a 0 as the sick person and accordingly your interpretations are going to be different. So far we have

discussed utility and health subject to the person's state. As I mentioned from the HSD, health state dependence models, medical care products must be produced in a society depending upon the health state dependence framework.

Where does health come from? After an inlays we can produce health or at least restore part of it by using medical care. Medical care simply a set of activities designed to restore or augment the stock of health. The production of automobiles etc. We use safer production functions similarly, but we can define the healthcare production function similarly in healthcare. It is derived based on our state of health. Medical products like automobile products are also derived based on different parts like steel, plastic, labor, tires, these are also demanded.

Accordingly, medical products are also, automobile products are also produced. Similarly in healthcare products are function of your medical care. We have mentioned H as a function of M that precisely explaining medical care. Health outcomes also depends on the disease profile of the person, a person carries and does the productivity of medical care which we have said.

It is not just M, we have to also address with D. Again how to explain our function, health production function, not just production function that not exactly the typical production function we should have. It depends upon the caring disease level, the disease level or the starting health state or the type of products to be sold in the market depending upon the state of disease at that level in an economy or in a country. Here we have highlighted disease 1, disease 2 and disease 3. The disease 1 case we are citing with allergies or asthma kind whereas disease 2 is a broken arm and disease 3rd type and its production function or the health production function is a simple common cold type. You can now easily guess where should be the starting stock of health when it is a common cold, common cold third case, the stock of health is considered to be much higher because a common cold level and whereas allergic disease 1 we have said here, where in the second case it is a broken arm, it is a serious case comparative to other two.

Therefore, the stock of health is considered to be compromised and accordingly the slopes of the health function, the production function is considered to be different. You just see when somebody is carrying with the disease 1, the disease 1 does not make the individual terribly sick initially without medical intervention. However, the medical care offers some help in healing and eventually reaching a near plateau level and hardly any further expectations are required. Therefore, there is a possibility of stagnance in their supply function itself.

Similarly, we will also be mentioning elasticities, etc., in our course. The nature of change in the production function are considered to be different in different examples.

For common colds, the changes are slightly different than in case of the disease 1, asthma and allergic conditions. Whereas a broken arm requires major support throughout.

Therefore, the function is different. You can just mark the changes. And now, for almost every possible medical intervention, there has reached some point at which the incremental productivity or the marginal productivity of medical care will fall very low or possibly even become negative. At the point where the marginal product falls to 0, the health versus medical care plot flattens out completely. The plot which have almost flattened out where the marginal productivity is near 0. That means the product and its production as per the type of disease considered to be non-necessary in the society and considered to be, relevance for the society is considered to be 0.

The marginal change is considered to be 0. We are explaining the complete model of consumption and health. Citing again once again with the other commodities and medical product. So X stands for other goods and M stands for the medical goods. Here again we need to define that what is this X, is it a good commodity or bad commodity or lifestyle choice of healthcare directly or indirectly affect our health depending upon your choice of goods you are consuming, positive good or negative good. We will also be using generalized form of this concept of production of health in Grossman model of demand for health where Grossman considered as an asset, as a capital to start with in the production function.

We will be discussing in our successive chapters. In this case, a person used to carry a health state but has to experience different health stock at a different lifetime. The life cycle is different depending upon the different complications of the person in different time period from birth to the entire life. The plot of the individual health stock over time is shown in this figure which I have already mentioned. This plot rises during childhood and gradually declines due to the ageing. Over time in between it has some random health shocks like illness, injuries, different level of injuries.

I think you can easily note these injuries are more complicated. The health stock is highly compromised and at the bottom of the ladder of our life cycle for health and medical care forms an important part of restoring health after such events. Insurance etc. dealt in different life cycles differently. Age minimum health stock has been also reached once we are addressing or reaching a different H level with different catastrophes or different health conditions.

The H at some critical level that is age minimum once it is crossed the person dies. This is all about the life cycle of the person related to health. The stock of health depreciates as we have already seen like durable goods. Increased life expectancy implies depreciation rate of people's stock has slowed down over time. These measures like to increase health like vaccinations, sanitation drive etc. or important checkpoint for your health. There are

some examples we have cited here like obesity, tobacco use, alcohol use that really attache to person's health and derive at the bottom level of your minimum stock of health. It might attache the persons or bring down the persons towards the minimum stock of health. We have taken the example and we compare with the utility level. The leading causes of death in US particularly cited in 2000 are related to unhealthy food habits.

Tobacco-related deaths were too huge, 435,000 deaths, nearly 18.1 percent, which is very huge. More diet and physical inactivity caused around 4 lakh deaths, which accounts for 16.6 percent. Alcohol consumption of 85,000 deaths accounts for 3.5 percent, as per the US data, as the author observed. We can also do research on our own in this regard as well. Similarly, another consequence of our inactivity or poor diet conditions leads to obesity. From the figure we can see between 1990 and 2000, you can also see the change in this diagram.

There is a rapid increase in death due to poor diet and physical inactivity. We have explained obesity has a strong effect on various forms of morbidity as well and that may lead to mortality or morbidity. Obesity is a strong association with diabetes many other comorbidities such as cancer, heart disease, gallbladder etc. What underlying economic phenomena might cause this obesity epidemic, etc., is explained.

Technological change is another important aspect of the production of health. Increased marginal productivity of workers leads to a fall in calories born in day-to-day life or in a day jobs have become more sedentary type and less strenuous. Value of time makes it more expensive to burn calories. Similarly, cost of acquiring calories have fallen because of technological improvements in the agriculture sector etc. Increased value of time also leads to more people shifting to fast food alternatives than compared to the better food. Even the consumption basket overloaded with fat or over-calorie-based products which is problematic for the human body.

Other references we have cited you can read. Transportation choices, factors, and higher gasoline prices might cause weight loss. Similarly, people have begun to shift to mass transit from personal driving, which entails more work, etc. There are indirect ways of understanding healthcare.

Some researchers have already derived important dimensions you can follow. I am sure. I do not emphasize tobacco and health; you may read on your own. Based on all sort of things, some of the other facts from the GATS data 2016-17 report, you can see users without formal schooling and their tobacco use data with education etc. In Indian context is presented in this data. Users without formal schooling, users with less than primary education, then users with primary but less than secondary education.

You can easily see which education has a positive role. Education helps in declining the rate. Inverse relationship is observed, education with tobacco use etc. and accordingly there are important implications and you please have a read and you will enjoy these examples. Alcohol is another massive consumption in different parts of the country and that is also explained over here.

I am not reading between the line. I think it will be useful for you to read. We have already mentioned education and health in our previous slide. Obesity declines with education derived in different papers. Propensity to undertake regular exercise rises with education level as derived by some authors. People with a high discount rate, those who offer immediate pleasure rather than investing in the future will not only opt against investment in education. Still, they will also engage in fewer health-producing behavior.

One other direction related to obesity, etc. One of the indicators is BMI. BMI is usually considered important in the parameter prevalence of overweight, etc. A BMI greater than 25 is considered overweight, whereas obesity is considered overweight once it crosses 30 as per the WHO standard. And that is among the US adults, as mentioned in this book.

You can also cross-check with WHO parameters for Asian standards. That is a little different. Especially in the study of BRICS countries, it was found that education attainment has a negative influence on obesity. Education is most effective in this case. The effect is even higher for females rather than males.

It has a cyclical relationship. It has reverse causality as well. Health affects education, and education affects health. Therefore, investment in both is required. It will derive better results for society. In short, what have we discussed? We have discussed the state of the person's health. We derive utility from our consumption of different commodities, but it depends upon the person's carrying capacity.

Who is consuming what? If a person is healthy, the consumption basket will be blissful and derive better utilities. Hence, we derive in our chapter called health state dependence. In short, with respect to health or sickness, if the marginal utility changes differently, you can present if the secondary derivative is positive. We have already mentioned that the incremental change is positive with respect to your sickness.

Therefore, it is deriving negative health state dependence. Be careful while reading; accordingly, we will set questions. We have also cited different lifestyle patterns which are adding to negative health state dependence. In the next chapter, we will clearly discuss the demand curve for healthcare products. How is it downward-sloping? What are the different evidence to randomize experiments from different scholars will be emphasized in our following lecture.

Please read the chapters we have mentioned in this book of Phelps, Charles E., and most importantly, the papers from Finkenstein et al. that we have also referred to in our work. With this, I should stop here. I will look forward to your attendance at the next one. Thank you.