Microeconomics: Theory & Applications
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Lecture – 17
Slutsky Equation

Hello. Welcome to the lecture series on Microeconomics. We have seen income consumption curve and price consumption curve in previous lecture. Now we are going to study comparative statics analysis in even better details. Today, we are going to talk about Slutsky Equation. Now what does that mean? When there is a price change, then the consumer faces 2 sorts of effects. One as price of one commodity changes, there is a change in relative price. So, the consumer faces at different exchange rate at which one good can be substituted with the other.

The second effect would be a change in the purchasing power. Suppose there is a fall in price of one commodity. So, the consumer will feel reach psychologically, because he or she has saved some money, if he or she decides to consume the previous bundle. So, with that extra amount of money, now the consumer can purchase extra units of both the commodities. So, how to deal theoretically with these 2 types of effects due to a price change? So, we are going to talk about decomposition of price effects into substitution effect and income effect.

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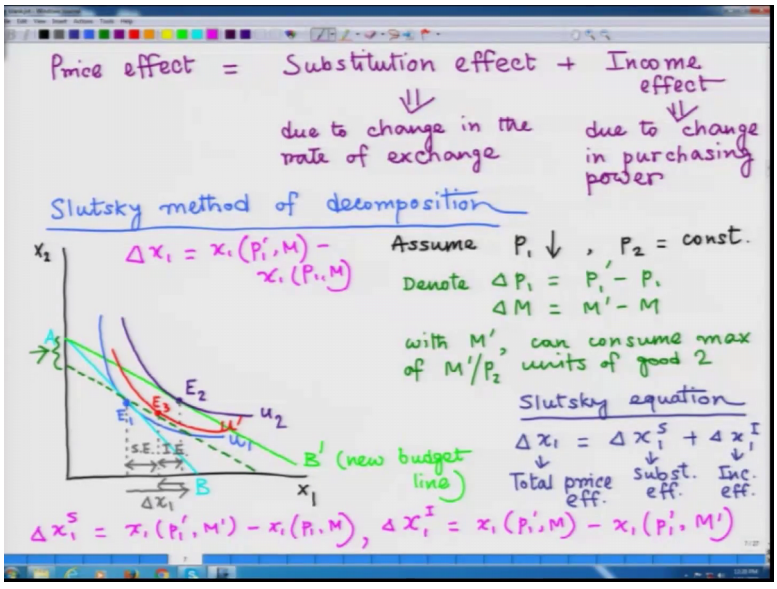

So, as there is a price change the total change in consumption demand for the commodity is called price effect, and that can be broken down into 2 different components known as substitution effect and income effect. So, the substitution effect takes care of the first defect that we talked about. So, this is due to the change in the rate of exchange at which the consumer can substitute one good for the other. And the income effect appears due to change in purchasing power.

Now, how to decompose this total price effect into substitution effect and income effect? That remain a very important theoretical question, and 2 economists approach this problem in 2 different ways. We are going to study both of them. First of all, we are going to study the method proposed by your Russian economist using Slutsky, and then we will follow this discussion with the method proposed by a Nobel laureate economist Sir John Hicks. So, first we will start with Slutsky method of decomposition. Before we go into the deeper details of these 2 different approaches, let us see how philosophically there different.

Actually the difference emerges from this fact how to compensate the consumer from a price change. So, to compensate the consumer from price change, the consumer's money income has to be adjusted. And Slutsky and Hicks proposed 2 different methods to do so. Let us now look at the Slutsky method with the aid of a diagram. This is slightly complicated. So, please pay attention the drawing of this diagram is not that easy. So, we are working with 2 commodities as usual x 1 and x 2. So, let us start with the initial budget line. We name it A B, then let us assume that there is a price fall. Price of commodity one has gone down while price of commodity 2 has remained the same. This is the case that we are going to analyze.

So, if this happens we know from our previous comparative static analysis that the budget line we will become flatter, because P 1 over P 2 has now gone down. So, let us say A B prime is the new budget line. Now we will look at the consumers equilibrium associated with 2 different price scenarios or budget lines. So, let us now superimpose the indifference map in this diagram. So, initially the consumer achieved and equilibrium point say E 1 which is the tangency point between the initial budget line A B and the initial indifference curve, say u 1. Now with this new price scenario a different budget line has been drawn A B prime.

So, of course, new equilibrium consumer equilibrium is going to emerge, and let us assume that the consumer now has arrived at the new equilibrium point E 2 which gives the utility level u 2. Now this journey from E 1 point to E 2 point actually is the total price effect. So, here we are going to only concentrate on the consumption of commodity 1 and not of commodity 2. So, this increase in consumptional commodity one is due to the total price effect. Now the target is to decompose this total price effect into it is components income effect and substitution effect. First let us talk about the substitution effects.

Now, as per the Slutsky method, we need to compensate the consumer for again in price, here price has fallen. So, consumer has some extra bit of money. Psychologically he or she is feeling richer. So, Slutsky says that we need to take out money from the consumer's pocket. Now how much money should be taken out of the consumer's wallet? Slutsky says that take out exact amount of money from the consumers pocket such that consumer is forced to consume the previous bundle, the original choice. How to go about that? So, Slutsky saying that if you take out money in such a way that the consumer is forced to consume the previous equilibrium consumption bundle, then one can draw a new budget line, this broken line.

Now, note there is the fall in money income, and that is depicted through the change in the intercept term. Let us now introduce some notations for analysis. So, as there is a price change denote delta P 1 is difference in 2 different price levels. There is also some money income adjustment going on and that is basically this. So, M prime is the new income, and M is basically the original income. So, with these 2 notations let us see what happens.

Now, note that with new income level M prime after reduction in money income, the consumer can consume maximum of M prime over P 2 units of good 2; which is lower than the previous amount, earlier it was M over P 2. So, that is why we observe a fall in the intercept here along the x 2 axis. This is due to the money income adjustment. Now as the money income adjustment has taken place, let us see with these changes condition with this changed condition how consumer is going to find his or her new equilibrium. So, for the new equilibrium we have to find again the tangency between in you know the changed budget line, the broken line and a new indifference curve. That can be done like this.

So, let us assume that the consumers new budget line this broken line is tangential to some indifference curve denoting utility level u prime, and the consumer reaches equilibrium at this tangency point, let me name this E 3. So, we can see that has some money income has been taken out from consumers wallet, the consumer now has to reduce the consumption of commodity 1 and fall is noticed of this magnitude. So, this magnitude is basically the income effect, because here the consumer faces the same relative price ration as the changed condition. And the difference which remains is the substitution effect. Because here the relative price ratio is different so, the exchange rate is different.

So, let me write down. So, this is the magnitude of the substitution effect, and this is the magnitude of the income effect. Now let us express this in mathematical notation. So, let us express the Slutsky equation first in mathematical notation. Let us you introduced some new symbols, we have already introduced this symbol for total price effect which is delta x 1, now the Slutsky equation or I sometimes it is also called an identity. We can have delta x s 1 that is a substitution effect the change in quantity consumption due to substitution effect, plus change in quantity consumption due to the income effect.

By the way, in some text book substitution effect is also called the pure price effect. Now let us note down the equations. So, let us start with this substitution effect first. So, delta x s 1 is equal to x 1 P 1 prime M prime minus x 1 P 1 M. And the income effect would be x 1 P 1 prime M minus x 1 P 1 prime M prime. Now if you add this to up, then your total price effect becomes x 1 minus P 1 prime M minus x 1 P 1 M. Now we are going to study the other method proposed by professor Hicks.

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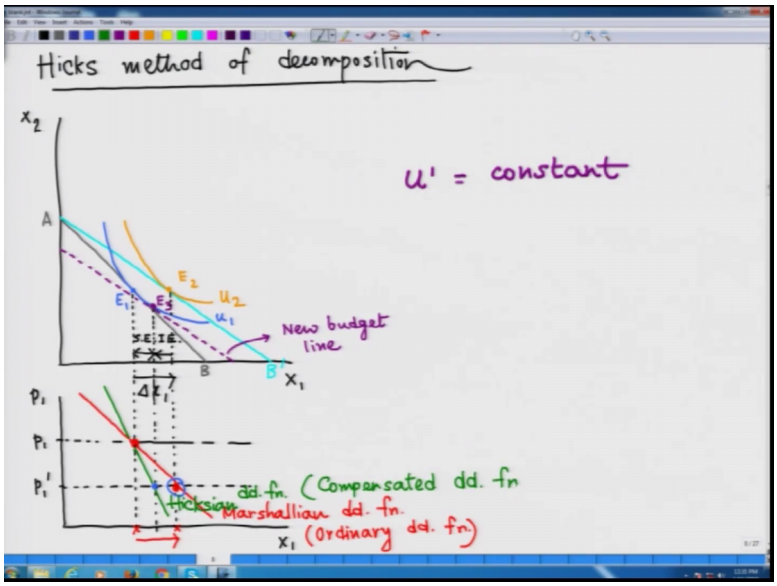

So, the best way to study Hicks method of decomposition would be through a diagram.

But while drawing the diagram we can also talk about the philosophy behind Hicks is approach. Why Hicks offered a different mechanism for money income adjustment? Hicks suggested that as we have to go for compensation due to a price change for consumer, let us fix the utility level for the consumer. So, when we are deducting money income for a price fall, than you know we should force back the consumer to the initial utility level where he or she belong to; where he or she found his first equilibrium for the original consumption choice or for the original consumption bundle; that is, I that is different from Slutskys approach because Slutsky said that it has to be the original bundle you know up you know where you need to force back the consumer. Hicks is say, no you have to force the consumer to the initial indifference curve.

So, let us start with again basic diagram where we have the original budget line say A B. Now there is a change in price and of course, the price has fallen. As we have assumed in the early you know previous case. So, the new budget line is A B prime. So, the consumer finds tangency between the initial budget line and indifference curve depicting utility level u 1. Consumer again reaches another equilibrium which is a tangency point between the new budget line A B prime, and a new utility level in depicted by indifference curve u 2; this is the new equilibrium point. Let me call this E 2 previously. Let me call the initial equilibrium point E 1. Now here lies the difference. Hicks

proposed that we need to compensate the consumer, we need to take out money from consumers pocket in such a way that the consumer is now forced back to the initial level of utility where he or she was before the price change.

So, as Hicks said that let us keep the utility fixed. So, if the consumer has started with an utility level u 1, let us keep that constant as well, and then later study, what happens if there is a price fall? So, Hicks suggested that let us take out some money from the consumers pocket, because the consumer is now facing a lower price level, and if we take out some money from the consumer's pockets, such that the consumer is brought back to the initial utility level we are talking about parallel downward shift of the budget line. So, that means, that we have to create a new budget line, whose slope is going to be the relative price ratio of the new budget line A B prime, but as money is going to be deducted this will shift in ward parallely.

So, this is the new budget line. This new budget line is now tangential to the old indifference curve, and this is another equilibrium point for the consumer is the consumer is charged with some money income, because he or she faces a lower level of price. So, in that case let us do this price rate decomposition exercise again, due to fall in price of commodity one the consumer increases consumption of commodity 1 by delta x amount. But note that if we take out some money from consumers wallet as we want to compensate him or her then the consumer finds a new equilibrium at E 3, and that will lead to reduction in consumption. So, this part is substitution effect, this part is income effect, right.

Now, let us see what is the implication of the substitution effect. So, this decomposition of total price effects in 2 parts is very important in microeconomics. These are several implications in the case of public economics and environmental economics, but we are not going to discuss them. But we are going to definitely see what is the implication of you know this substitution effect why this is so important. The substitution effect actually gives a downward sloping demand function. How come? If you note that we are talking about tangency points along the same original indifference curve as the price falls or price increases, whatever be the direction of the change.

We are following Hicks method, then we are pushing the consumer back to the original indifference curve. So, if the case of price fall happens. So, you are talking about that the

consumer has to find up point to the south west of it is initial position, because now as the price of commodity one has gone down, now the budget line has become flatter. So, the consumer has to move along the indifference curve to the southeast reaction such that it reaches a point on the indifference curve where the slope is less. So, that means, that convexity of indifference curve or the law of diminishing marginal rate of substitution is playing a big role to find out that the demand curve is actually a downward sloping function.

So, with this diagram, we can also introduce a new concept called Hicksian demand function or the compensated demand function. So, let us talk about 2 different price levels. Say P 1 to start with and then there is a fall in P 1. So, P 1 prime and, let us now superimpose this consumption choices on this panel be graph. So, if you want to drop the demand curve, that we have seen earlier the Marshallian demand functions, we have to talk about the total price effect. So, these 2 are the points as price of commodity one falls from P 1 to P 1 prime, there is the quantity demand increase for commodity one from this original point 2 this point. If I join these 2 points, we get what is called a Marshallian demand function.

Note that I am joining them by a straight line. It may not have to be a straight line for simplicity. Say, I am joining them by straight line. So, this is known as Marshallian demand function. As this is the mostly used demand function in economics, this is also known as ordinary demand function. Now if we focus only on the substitution effect, then we can see that the demand increase is only up to this point, and not up to that point. So, one can also join this blue point with the initial rate point. And if we join this 2 by say another straight line. Then that also depicts a relationship between price of a commodity and quantity demanded of that commodity, and this new stripper demand function is known as Hicksian demand function. As this is coming from income and adjustment and compensation of the consumer from a price change this is also called compensated demand function.

So, when we approach this problem of total price effect decomposition what way to go? We can think of a 2 step procedure. As price of a commodity changes, we have seen there are 2 types of effects, you know, the change in the relative price ratio and change in the purchasing power. So, we can fix one at a time and study the impact of the change in the other.

So, in the first step we can let the relative price ratio or the exchange rate vary while keeping the purchasing power constant, and then this step trip could be followed by fixing the exchange rate you know at it is current level and then allowing the purchasing power to change, and study what impact it will have on the consumption of commodities. In the next lecture we are going to continue with this discussion on Slutsky equation, and we are going to get into some advanced topics in consumer theory.