14.01SC Principles of Microeconomics, Fall 2011
Transcript – Lecture 6: Deriving Demand Curves

PROFESSOR: We're going to start with an interesting application of demand curve analysis, of the kind of indifference curve and constrained choice analysis we've been doing, the case of food stamps. And then we're going to move on and talk about deriving demand curves.

So let's talk about food stamps. It's an interesting case. This is a policy that's been in place in the US government for a very long time, which are essentially coupons that individuals can use to buy food. It used to literally be coupons. It used to literally, you'd get a stamp, a coupon, and you'd go to the supermarket and hand this in instead of cash to buy your goods.

Now it's actually a debit card. And it's given to low-income individuals as a way of redistributing income in society. So individuals of income below a certain level, typically, say, a family with income below about $25,000 a year, below what we call the US poverty line, will be eligible for food stamps, which is a debit card they can use to charge their food purchases.

Now, what I want to talk about today is how we can use the kind of analysis we've done so far to think about the effect of food stamps. So let's start with figure 6-1. And let's think about someone with an original budget line. If someone has a budget line, they have income of $1,000. OK, a very poor person, they have income of $1,000. And let's talk about them, their choices between food and all other goods.

Once again we have this analysis. We put everything in two dimensions. What we think about is via mental accounting, as we talked about last time. However you want to justify it to yourself, the way we model it is thinking about people having this choice along two dimensions, food and other goods, and they have income of $1000.

Let's say we'll have two individuals, individual x and y. Individual x doesn't care that much about food. They really like consuming other goods. So they spend $600 of their income on other goods and $400 on

food. Individual y cares a lot about food. They end up spending $900 of their budget on food. And that should be 100. 100 on other goods. So that y-intercept should be 100 for person y. So they spend 900 on food and 100 on other goods.

Now let's say the government comes in and wants to consider two options. The government decides, look, we want to help poor people. And particularly we want to give people like these people $500 in resources. Let's think of two different ways the government could do that. One way the government could do it is it could give them cash. It could say, look, we're going to send you a check for $500. What would that do to their budget constraint?

Well that would shift it out, as we talked about last time. It would be an outward shift of $500 at every point. So their new budget constraint would be the line that runs from $1,500 of all other goods to $1,500 dollars in food. So include that. So both the solid and dashed portions would be their new budget constraint. So the new budget constraint would run from 1,500 to 1,500.

Person x would choose to move from x1 to x2. I'm sorry, they would choose to move from x1. It's not labeled as a point. But they would actually choose to move from indifference curve 2 to indifference curve 3. OK, that's where they'd choose to move if they could choose along this entire line. Let me sort of, well, I'm not going to draw it, because I'll do a bad job. But basically, if you can think about the new budget constraint running from 1,500 to 1,500, person x would move from indifference curve 2 to indifference curve 3. They would choose--

Actually, you know what? Let's put this graph aside. It's not quite right along the number of dimensions. I'm going to draw this, because there's a number of problems with that. So you've got an original budget line that runs from 1,000 to 1,000. And we've got person x up here, and they're choosing to spend 400 on food and 600 on other goods. And we've got person y down here. This is person x, and they're in section x1. And person y intercepts at y1 where they choose to spend 900 on food and 100 on other goods.

Now, the government first says, look, we're going to give people $500 in cash. That just shifts the budget constraint out parallel, but now runs from 1,500 to 1,500. Let's say that the choices people make-- Person x would say, great, I'm going to take that money, I'm going to spend almost all of it on other goods. So I'm going to move to a point like x2, where I'm going to consume $1,200 on-- I'm going to consume-- They were consuming-- No, I'm sorry. 15, right. They're going to move from spending $600

on other goods and $400 on food to spending $1,100 of their dollars on other goods, and-- let me think for a second.

Let's say they would go vertically. So let's say they'd choose to spend all of it on other goods. So they'd take the whole 500, and they'd go from spending-- they'd continue to spend 400 on food, but now they'd spend 1,100 on other goods. So person x, they would continue to spend $400 on food. They'd say I'm going to take that entire $500, instead of spending $600 on other goods, I'm going to spend $1,100 on other goods.

Let's say person y, they would say, well I'm going to sort of split it. I'm going to spend some on food. So this is their new intercept x2. I'm going to spend some on food, and I'm going to spend some on other goods. So I'm going to go out here. I'm going to spend now-- instead of spending $900 on food, I'll spend $1,200 on food. I'll take $300 and spend it on food. Instead of spending $100 on other goods, I'll spend $300 on other goods. OK, so that's person y2. OK, so that's what they'd do if we gave them $500 in cash.

Now say the government came in and said, you know, we're going to give you $500 but in the form of a coupon that you can spend on food. So the first question is, what does that do to the budget constraint? This is a bit tricky. We've got to think about this. Think about their budget constraint. What that says is for anyone who wants to continue to, at least spend $1,000 on-- anyone who wants to at least spend $500 on food, it does not change their opportunities at all.

So the new budget constraint looks like this. It's a solid line to here, and then it goes down. This intersects at 500. It's a solid line to the point at $500, and then it goes down and follows the old budget constraint. Why does it do that? Because for anyone to this side, they are $500 richer regardless of whether you give them cash or food. Either way they're $500 richer. Why? Because as long as you intended to spend $500 on food anyway, it doesn't matter the form in which the government gives you the money. Think about that for a second. It's very important. If you were going to spend $500 on food anyway, it does not matter if the government gives you a check for 500, or a food card for 500. Why is that? That's because your budget is what we call fungible. You can always move money around within your budget.

So let's say you're spending 500 on cash. Let's take a person like y. Let's take a person like y. They were spending 900 on food and 100 on other goods. The government comes in and gives them a food card for 500. Well to them that's the same as $500 in cash because they're already spending $900 on food. They can just take some of the cash on food, spend it on other things, and use the card for the food instead.

So for them, there's no difference in giving them cash or giving them the food card. It has the same effect. They move to y2 either way.

Now let's take a person like x. Well, if you gave them cash, $500 cash, they'd spend none of it on food. So they've been consuming $1,100 of other goods and $400 of food. But they can't do that if you give them a food card, right, if you give them food stamps. That's not a choice. They are now constrained to move to a point like x3. They're now constrained to move to a point like x3 where they have to go to this intersection. Because this point is not attainable. This point is not attainable. If you give them food stamps, the new budget constraint is this. So x2 is no longer attainable. They have to move to a point like x3. So what do we know about their level of happiness at x3 versus x2? Someone raise their hand and tell me. Yeah.

AUDIENCE: It's lower.

PROFESSOR: It's what?

AUDIENCE: Lower.

PROFESSOR: It's lower. And how do you know that?

AUDIENCE: Because it's kind of like, if it was on the full curve, they would be elsewhere.

PROFESSOR: Well OK, so there's two different ways to see it. One is you could say, look they're at a lower indifference curve. You can see what's wrong with this graph. The indifference curves cross. The indifference curves can never cross. So that's wrong there. They're on a lower indifference curve, OK. But what's the other way to think about it?

AUDIENCE: The marginal rate of substitution and transformation aren't the same.

PROFESSOR: The marginal rate of substitution and transformation aren't the same. That's another way to think about. And that's always true at the optimum. But what else do we know about a point like this? They could have chosen that point before and didn't. Right? When they had the cash, they had the option of choosing this point, but they didn't, they chose a different point. So we know by something called revealed preference that they're worse off.

This is a very important concept. If someone makes a choice that they turned down before, then by revealed preference they're less well off. We've revealed that they're worse, because they could have chosen this point before, but they didn't. When you gave them the cash, they chose this point. So by revealed preference we revealed they're worse off. So it's the same as saying their indifference curve is lower. We've revealed they're worse off.

So what we've learned is for person y, they don't care if you give them cash or a food card, food stamps. It's called food stamps, but it's now a debit card. Person x is made worse off if you give them the food stamps instead of the cash. Why do it? You're the government. The US government spends $35 billion every year giving people food stamps instead of cash. Why don't we just take that $35 billion and give it to them in cash? Yeah?

AUDIENCE: Probably because the government doesn't trust people to spend it on what they actually need. And that will just lead to more poverty and people wasting it on things they don't need.

PROFESSOR: Or to put it more succinctly, what if this axis was not labeled other goods but labeled cocaine. Then we might be sad that you took the whole $500 and spent it on cocaine. We might want you to take that $500 and spend it on food. So it's paternalism. The reason we give the guys food stamps instead of cash is we don't trust them with the cash.

If we trusted people with the cash, there'd be no reason not to give them the cash. We are unambiguously making them worse off by forcing them to consume a bundle that's on a lower utility curve, lower indifference curve. But since we don't trust them, since we're paternalistic, we are willing to go ahead and force them to do that.

So then the interesting question becomes, well, how much are we costing them? In fact, it's not obvious. If everyone in the world looks like y, then there's no cost to food stamps. There's no good done either. Then it doesn't matter if we give them cash or food stamps. But if a lot of people look like x, then there

is a welfare cost to people. They are worse off, from their own perspective, getting food stamps. Society may think they're better off.

So how do we tell? How do we tell? Can anyone take a guess? If you're now an empirical economist, and you want to test, how would you tell if people are like x or like y? Any ideas? It's tricky, but let's see if we have any budding empirical economists here. Yeah?

AUDIENCE: You'd see if they're spending any cash beyond the $500 that you gave them, because then you'd basically [UNINTELLIGIBLE].

PROFESSOR: See if they're buying food beyond the $500 you gave them.

AUDIENCE: They might spend $100 cash on food.

PROFESSOR: Excellent. So that's one way you'd do it. You could look at people who get food stamps and see if they're spending more. That's a great idea. The other thing you could do is you could actually literally run an experiment where you take people who are getting food stamps and replace them with cash or vice versa and see what happens to their behavior.

When we do this, we find that about 15% of people are like x. Or in other words, the way to say it, is about $0.15 more precisely. When you give people food stamps instead of cash, they spend 15% more on food than they would if you just gave them the cash. So there's about 15% lower utility compared to what they'd want for spending it on the food instead of the cash.

So the question is, is it worth it? We're basically taking people and making them spend $0.15 more on food than they'd want to. That's the right way to think about it. If you give them food stamps instead of cash, they spend $0.15 more on food than they would if you just gave them cash. Is it worth it? That's a great question. It depends on how stupid we think people are and how paternalistic we want to be.

If we think people would really waste the money, then $0.15 is not much to give up to make sure they eat. If we think nobody would waste the money, then we're just throwing $0.15 down the toilet by

making them buy food instead of goods they prefer. And that's the interesting kind of public policy question we have to struggle with. We think about government policy and redistribution. That's exactly the kind of question we need to struggle with. And we'll come back to that again later in the course when we talk about efficiency versus equity. OK, questions about that? Yeah?

AUDIENCE: [INAUDIBLE PHRASE].

PROFESSOR: Sure. I mean, so basically you make a good point. We sort of like to know. Actually that's a very good point. You say, when we run these experiments and replace the food stamps with cash, we like to know what they spend the cash. We want to know not just what happens to food consumption.

So if you run the experiment, and you say, I was giving you food stamps. I now cash you out and give you cash. And I find you spend 15% less on food. Well what do you spend more on? If it's clothes, maybe we're not so worried. If it's cocaine, maybe we are. So that's a very good point. That's something we could look at. Excellent.

OK, so that's an example of how we can use the kind of analysis we did last time to think about policy making. Once again, this is an incredibly simple framework, right? Yet I just described to you a succinct way to think about the implications for society of different government policies. That's the power of this kind of simplified framework.

Now let's move on, and let's get to the core of why we did all this. The reason we did all this is we wanted to figure out how we come up with demand curves, where demand curves come from. The stork doesn't bring them. Demand curves come from underlying utility maximization. And we'll see that now. And basically the way to do this is to return to our example from last time.

Your parents gave you $96. You could buy movies at $8 a pop or pizzas at $16 a pop. So we said last time, if you turn to the next page of the handout. What we said last time is if given your utility function, u equals square root of p times m, you would choose a point like a. If the price of pizzas was $16, the price of movies was $8, your income was $96, you would choose a point like a, where you consumed-- At point a, you're consuming six movies and three pizzas. Once again that should be p on the y-axis. You're consuming six movies and three pizzas at point a.

Now let's say the price of pizzas rises. I'm sorry, now let's say the price of movies rises to $12. So the price of movies rises from $8 to $12. Well what does that do to the budget constraint? That steepens the budget constraint, moves it inward. Because now think about your opportunity set. For the same income of $96 you can buy the same number of pizzas you could have before, but now you're buying fewer movies. Same number of pizzas you could have bought before, but now you can buy fewer movies.

So your new budget constraint, you have a new constrained opportunity set. With a steeper budget constraint, the slope, instead of being minus 1/2, is minus 3/4. And given the preference I wrote, u equals square root of c times m, you should be able to show yourself that you'd now choose a point like b, where you have three pizzas but now only four movies. So you reduce the number of movies, you keep the number of pizzas constant. And you check that we still spent our total budget. Well, 4 times 12 plus 3 times 16 is still $96. So we're still spending our total budget. The marginal rate of substitution you can compute if you write it down from that utility function, will be minus 3/4, which is the same as the marginal rate of transformation with this new price. So you will choose a point like point b.

Now let's say instead the price of movies fell from $8 to $6. Well in that case, your budget constraint would flatten. It would move outwards. Your opportunity set would expand in that case, because effectively you're richer. Your opportunity set expands. You move to bc little 3. You move to bc little 3. And given those preferences I wrote down, u equals square root of p times m. u equals square root of p times m. You end up choosing point c, with the same three pizzas but now eight movies.

Once again, how do we know that's right? Well first of all the marginal rate of substitution, you can compute, will equal the new marginal rate of transformation. And also you can see you spend your entire $96 income. You're still roughly splitting it with $48 on movies and $48 on pizza, exactly splitting it.

So all we've done here-- Forget the bottom diagram for a second. All we're doing in this top diagram is saying, given your utility is u equals square root of p times m and given your income and the prices, these are the choices you would make as prices change. Are there questions about that?

Now armed with that, we can draw a demand curve. Because what have we done? We've just given you three different prices for movies and three different quantities of movies you choose. We know when the price of movies was $8, you chose six movies. That's point b. I'm sorry, that's point a. The points are

mislabeled too on this. I'm sorry. If you go to this bottom graph, these points are mislabeled. So it should go b, a, c. It should go b, a, c.

So when the price of movies is $8, that's point a in the middle, you choose 6 movies. When the price of movies rises to $12, your demand for movies falls. You only choose 4 movies. When the price of movies falls to $6, you choose 8 movies. Thus the demand curve.

And we're done. That's where demand curves come from. They just come from utility, constrained utility maximization. You just take your utility function, you maximize it, given the constraint the budget constraint places on you, and boom, you have a demand curve. Now note that this a particular case we did. And it's a particular case that's interesting. In this case as we change the price of movies, what happened to demand for pizzas?

AUDIENCE: Stayed the same.

PROFESSOR: Stayed the same. That is a particular case. It's basically the case that will happen with utility function of this form. It's a case of what we call no cross-price elasticity. This example has no cross-price elasticity. What that means is that in this particular case we chose, as the price of one good changes, it does not change your demand for the other good. That's a special case that will not in general be true.

You can imagine if your income was only $96, and the price of movies was swinging around, that might affect your taste for pizzas. That might affect your demand for pizzas as well, because you're only have a fixed budget. That's a more general case. We've chosen a particular case here with no cross-price elasticity. But don't think that's general. This is not a general lesson. There's the price of one good changes the other goods unaffected. In fact, in general, both goods will be affected when any one price changes. That's a more general result.

You should be able to check at home that you can do this exact same exercise for pizzas and draw the demand curve for pizzas the exact same way. You'll still get a flat-- you'll still get no cross-price elasticity. You'll still get this flat curve-- well now it will be vertical curve with respect to movie purchases. But you can see as you change the price of pizzas, you'll find a well-defined pizza demand curve as well. OK? So that's where demand curves come from. We basically maximize utility at different prices given your income, and we end up with a demand curve that shows us the relationship between how many movies you choose and the price of movies.

Demand curves themselves can also shift. We talked about that in the second lecture. We talked about demand curve shifting. And one reason demand curves can shift is because you get richer. So let's talk about how that can happen. Let's now turn to figure 6-3, which is really tiny. My bifocals are in at the mall. I just haven't picked them up yet. So let's take the glasses off for this one.

Now let's take a case. Once again, originally you're at point a, where you're choosing six movies and three pizzas. Now let's say your income rises. Your parents are feeling generous. And instead of giving you $96, they're going to give you $128. Once again, on that y-axis it should be labeled p, not c. You can now afford up to 8 movies and up to 16 pizzas with your $128 income. So your budget constraint has shifted outwards from bc1 to bc2. At that new higher budget constraint, you're going to choose, instead of choosing a, which is six movies and three pizzas, you'll choose b, which is eight movies and four pizzas. You're richer so you choose more of both.

Likewise if your parents cut your income to $64, you're budget constraint will shift inwards. Your opportunity set will be constricted. You move to budget constraint three. And you choose fewer of both pizzas and movies.

So you can see as your budget constraint shifts, how you choose different amounts of both pizza and movies. We can translate that to shifting demand curves for movies. So if you draw that down to the next diagram, you say, look, I can now graph that at a given price of movies-- prices have not changed in the example. The slope of the budget constraint is the same. Only your income has changed.

At a given price of movies of $8, as my income changes, I am on different demand curves. You can see the demand curve for movies shifting out and in as my income changes. So as my income went up, the demand curve for movies went out and moved from point a to point b. As my income fell, the demand curve for movies went up, shifted in, moved from point a to point c.

We can then drop that down one more level, just to make life especially interesting, and draw the relationship between your income and your demand for movies. And that's the third figure. Here we graph the relationship of your income and your demand for movies. This is not a demand curve. Demand curves only relate price to quantity. This is what we call an Engel curve. Those of you who studied your socialism theory will remember Engels worked with Marx. It's not him. It's Engel not Engels. Different guy.

So basically this is an Engel curve. And basically it shows the relationship between your income and your demand for a good. And this turns out to be a very important concept. Because an important thing that we'll focus on now is what we call the income elasticity of demand. We've talked about price elasticities. What's the price elasticity of demand? Someone quickly, someone raise their hand and tell me, what's the price elasticity of demand? Get some other folks involved here. Yeah?

AUDIENCE: How demand changes with the price of the item?

PROFESSOR: Right, so as price changes, how demand changes. The income elasticity is the same concept. It's a change in demand as your income changes. In the book it's this fancy letter. I can't write, so I'm going to call it gamma. But it's some c thing that I can't draw in the book. Which is delta Q over Q over delta y over y. So just like the price elasticity is the percentage change of quantity, percentage change in price, the income elasticity is the percent change in quantity with percent change in income.

Once again, just like price elasticities are locals. You talked about it in section. You talked about, sort of, local versus global price elasticities and how it's really local to that segment of the curve. Income elasticities are local too. Your income elasticity will obviously change along an Engel, could change along an Engel curve. But the key point is that for most goods the Engel curve is upward sloping. That is for most goods, this is greater than zero. Just like we talked about the price elasticity being less than zero in general, this is less general, but for most goods, the income elasticity is greater than zero. We call these normal goods.

Normal goods are goods for which the income elasticity is greater than zero. As you have more income, you buy more of them. On the other hand, if the income elasticity was less than zero, we would call those inferior goods. Inferior goods, goods where as your income goes up, you buy less of them. Yeah.

AUDIENCE: Is there any term for when income elasticity equals zero?

PROFESSOR: If it equals zero, you're just income inelastic. It's in between normal and inferior. I don't think there's a precise term. You're just income inelastic. So can someone tell me how you could get an inferior good? Does anyone have a good idea of an example of an inferior good? How could a good be inferior? Yeah.

AUDIENCE: Canned food, because if you have a low income, you buy canned food because it's cheaper. But [INAUDIBLE].

PROFESSOR: Exactly, so canned food versus fresh food. As your income goes up, you'll substitute away from canned food to fresh food. So actually as you get richer, you'll consume less canned food. So canned food is an inferior good. Excellent. The classic example uses potatoes. Potatoes is a good cost-effective, cheap source of nutrition. But, you know, no one wants to eat potatoes all the time if they don't have to. So when the income goes up, we substitute away from potatoes towards arugula or whatever.

So basically, essentially we could think of inferior goods as goods-- Once again, more is always better. There's no goods we don't like. More is always better. But there are goods we'd like to substitute away from. We'd like to have others instead. And goods you substitute away from as you get richer are inferior goods. Goods you move towards as you get richer are normal goods.

Moreover, we can break this down further. Within the class of normal goods we can talk about gamma less than one and gamma greater than one. Any guess as to what terms I'll use for gamma? Any examples in, sort of, the class of goods where it would be less than one versus greater than one? What's an example of a good that would be less than one? Think about what that means. Yeah.

AUDIENCE: Perhaps food, because if your income [INAUDIBLE PHRASE].

PROFESSOR: Right.

AUDIENCE: [INAUDIBLE] if your income increases.

PROFESSOR: Excellent. So we call these necessities. And we call these luxuries. Goods where the income elasticity is less than one are necessities. You want more of them as you get richer. But you don't want as much more as you get richer. So you've got the food as the classic example. As your income doubles, you're going to eat more food but not twice as much food.

Likewise luxuries are things where as your income doubles, you'll buy more than twice as much. So you think about fancy cars. You might buy one with your first million but three with your next million. So those are luxuries. They'll increase more than proportionally as your income goes up. Necessities will increase less than proportionally as your income goes up.

Now, of course, it's a very hard distinction to draw. And of course it varies by person. So take clothing. Is clothing a necessity or a luxury? Well, some clothing is probably a necessity, and some clothing is probably a luxury. You know, Dolce and Gabbana is a luxury. You know, Keds is a necessity. Or whatever, I don't know, what, The Gap is a necessity.

So basically we could think about, it's actually a subtle distinction what makes luxury and what's-- Normal versus inferior is kind of stark. Luxury versus necessity, that's a little bit trickier. That's going to depend on the person and depend on the type of goods. But it's important to understand that concept. OK, questions about that. Yeah.

AUDIENCE: I have a question in general. Is there a way to relate income elasticity to, like, own-price elasticity?

PROFESSOR: Actually that's a great question. That's a great segue to what we're going to do next. It's actually a fundamental determinant of own-price elasticity, and we'll talk about why next. Other questions about this concept? Yeah.

AUDIENCE: [INAUDIBLE PHRASE]?

PROFESSOR: Yes, income elasticity is, once again, just like price elasticities are not necessarily constant. You could have a constant income elasticity curve or a non-constant income elasticity curve. It can absolutely change. In general it will. But it might not. Good questions.

But that other question in the back, gee, how does this relate to own-price elasticity? Great segue. In fact the income effect is going to be one of two key determinants of own-price elasticity.

Now what we're going to do is we're going to go even further behind the demand curve. We talked about the demand curve comes from. We talked before about how the slope of the demand curve is the price elasticity. Remember, the price elasticity was the slope. Now we're going to talk about where does the slope come from. Where do price elasticities come from? So I've shown you where the demand curve comes from. Now let's talk about what determines the underlying slope of the demand curve. What determines the price elasticity. And what's going to determine it is two different effects which work generally together but sometimes in opposition.

There are two effects that determine price elasticity. The first is the substitution effect. The Substitution Effect is the change in quantity demanded when price increases holding utility constant. So the Substitution Effect is delta p-- it's in percentage terms-- delta p over p, over delta q over q, holding utility constant at a fixed level u bar.

So given that your utility has not changed, how does your demand for the good shift? We're now getting kind of deep. Think of this as, as a good gets relatively expensive, how do you shift away from that good? Think of this as the shift away from the good as it gets expensive.

But at the same time, there's a second effect which we just introduced, which is the Income Effect. The Income Effect is the complement of the Substitution Effect, which is the change in quantity demanded because of a change in income holding prices constant. So this is the Income Effect we just introduced. So it's delta Q over Q over delta y over y. But this is holding prices constant. And these two put together determine your own elasticity demand.

Think of it intuitively. We'll do it intuitively, and graphically, and mathematically. Intuitively, it's when a price goes up, two things happen. On the one hand, you're like, gee, at that different price ratio, I might want to substitute my consumption bundle. The second is, gee, the price just went up, I'm effectively poorer. And that's also going to affect my demand.

So to see that let's go to the graphical analysis and figure 6-4. And we're going to actually decompose income and substitution effects. This is one of the things that's sort of hard to do it intuitively. The graphics kind of makes it the most clear.

We're going to start at a point like a. Point a is our initial equilibrium at our budget constraint one, where we're choosing six movies and three pizzas. Once again, this is pizzas not CDs. We're choosing six movies and three pizzas. That's at point a. Now we're going to say imagine the price of movies has risen to $12. Well we know that ultimately you'll end up at a point like c. We demonstrated that before. That was when we derived the demand curve for movies. We know that if the price of movies rises from $8 to $12, your demand for movies will shrink from six movies to four movies. We already established that.

But now what we can see is that that's actually a composition of two effects. The first effect is the Substitution Effect. And the Substitution Effect is the change in prices holding utility constant. How do we hold utility constant? You have to be on the same indifference curve. So the way to measure the Substitution Effect is we effectively draw an imaginary budget constraint. We say, look, imagine you're on the same indifference curve, but prices changed. So we draw budget constraint-- you're originally on budget constraint one.

Now we draw a new budget constraint, budget constraint three. Budget constraint three, it's sort of hard to see. Budget constraint three is drawn so that it has the new price ratio. That is, it's parallel to the final budget constraint bc2, but it's tangent to the original indifference curve.

This is hard, so let me just walk this through again. You've got your original budget constraint, bc 1. You chose your point a. Now the price of movies has just increased, so you move to bc2 in reality. And at bc2, you choose point c. But for the Substitution Effect we're going to say, let's hold utility constant and ask what package you'd choose at these new price holding utility constant?

Well the way to do that is to draw an imaginary bc3-- bc3 never existed in reality-- that is parallel to the new budget constraint, that is the new set of prices, but it's tangent to your old indifference curve, that is utility is constant. If that were the case, you'd choose point b. You'd choose 4.89 movies. Therefore we say that the Substitution Effect is 1.11. We reduce your movies by 1.11 through the Substitution Effect only. The price change only, holding your income, holding utility constant, is 1.11.

Then we say, well, what's the Income Effect? The income effect is given prices are fixed, what's the effect of just being poorer, because movies are now more expensive. We know how to make someone poorer, we just lower their income. So we shift from bc3 to bc2 and from point b to point c, and we're done. We get the total effect of the price. So we have to shift from a to c is all that you see in the real world. But behind that is the Substitution Effect which shifts you from a to b and the Income Effect, which is this parallel shift inwards of the budget constraint, which shifts you from b to c.

I'm going to go through that again in a minute. But let me first answer these questions, then I want to show you some of the math of this. Are there questions about what's going on here? Yeah.

AUDIENCE: The income effect can have either sign, right?

PROFESSOR: The income effect can have either sign. Excellent point. What have I illustrated here? What kind of good is this? This is a normal good. Excellent point. This is a normal good. I've assumed a normal good. And this should actually say in the title income and substitution effects for normal good. So I've assumed a normal good. And we know this student aptly pointed out the normal good, because we know that as your income fell, moving from point b to c, you consumed less of it.

This comes to the question that was in the back, which is as the price changes, whether we consume more or less is related to the Income Effect but doesn't tell you precisely what the Income Effect is. But as your income changes, if you consume more or less, that's directly Income Effect. So we see it's a normal good. So the Substitution Effect moves us from a to b. The Income Effect, from b to c.

What I want to do is one more thing before we stop. And then I'm going to come back next time and go back over this and then talk about some applications. What I want to do right now is I want to-- The Income Effect, say the following, the sign is ambiguous, because it depends on if it's a normal or an inferior good. The Substitution Effect is unambiguous. Substitution Effects are always negative. Holding utility constant, a price increase of a good always shifts you away from that good. Negative or less than or equal to zero could have no effect. But once again, I always talk in inequalities even though they're typically inexact.

The key is the Substitution Effect is always negative. We can think about this in two different ways depending on how you want to think about it. Graphically we could show this by the fact that if the price-- think about it graphically. If you're on the same indifference curve as you were before-- that's the definition of Substitution Effect where I keep the same indifference curve-- but you're tangent to a steeper budget constraint, which is what happened when prices go up, you must be choosing less of the good.

Think of it graphically. Just look at the graph. I'm in the same indifference curve. But to be tangent to a steeper curve, it's going to have to be to the left. So graphically it's going to have to be that I'll choose fewer movies when the price of movies goes up. That's graphically.

Mathematically we can just say, look, what do we know is our rule for utility maximization? We know our rule for utility maximization is that the marginal utility of movies over the marginal utility of prices equals the price of movies over the price-- marginal utility of pizza. I'm sorry. Marginal utility of pizza. So the price of movies, so the price of pizza. Or the MRS equals the MRT. We know that mathematically. That's our maximization condition right?

Well if the price of movies goes up, holding the price of pizza constant, then the right hand side has risen. If the right hand side rises, then the left hand side has to rise to get this equality. How does the left hand side rise? The left hand side rises by either the marginal utility of movies going up or the marginal utility of pizzas falling. And how do you do that? By shifting away from movies towards pizza. How do you make the marginal utility of movies go up? Consume fewer movies. How do you make the marginal utility of pizza go down? Consume more pizza.

Now in this case, pizza doesn't change in this particular case, but in general it can. But the key point is you are going to see this Substitution Effect is going to shift you towards fewer movies to try to get-- basically because given utility constant, to try to equilibrate this, you're going to have to move to a higher marginal utility of movies. Given that the price of movies has gone up, you're going to have to move to worlds where you care about movies more, or you're not in equilibrium.

Think about it this way. If the price of movies goes to $100 a movie, and you're going to be indifferent to where you were before, on the same utilities you were before, it can't possibly be true that you consume the same number of movies. You'd have to be sadder if you consumed the same movies. You're going to have to move away from movies. And that's why the Substitution Effect is always negative. You're always going to move away from the good where the price increases, holding utility constant.

But then we have the second effect with the Income Effect, which then basically, if the good is normal, reinforces that Substitution Effect. It says not only do you not want movies because they've gotten more expensive, you also don't want movies because you're poorer. Your opportunity set's restricted. And when your opportunity set's restricted, you buy less of everything including movies. So there's two reasons. We only saw one own-price elasticity demand, one shift. But there's two reasons behind that.

The first reason is because the relative prices have changed. And the other is because you're effectively poorer. You add those up, and you get the final effect.

Now the first, as I said, is unambiguous. That Substitution Effect will always move you to the left. You're always going to want less of a good if its price goes up from Substitution Effect. The second is ambiguous. That depends on whether the good is normal or inferior.

Next time we'll talk about what happens with inferior goods. With inferior goods, we can see that we can actually get what we call a Giffen good. A Giffen Good is a good where it's inferior, so the income effect goes the other way. And you can actually technically get a good where when the price goes up, you actually want more of it. When the price goes down you want less of it. That is, you can get a wrong sign, wrong slope demand curve.

I say demand curves always slope down. I might even refer to it as the law of demand. That's not technically true. Technically there exist goods, we'll talk about the next time, called Giffen Goods where you can actually get the demand curve sloping the wrong way. The price increase can actually cause you to want more of it.

In fact, these are based-- I like the name Giffen because it's close to griffin. And griffins are imaginary and so are Giffens. In fact, there's no evidence such goods exist, but it's a nice theoretical concept to build your understanding of Income versus Substitution Effects. So for next time think a bit about how that could be. And we'll come and show you graphically how you can get Giffen goods depending on the sign of the Income Effect.

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