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JONATHAN GRUBER: We are talking about how consumers make decisions. Last time we talked about preferences and utility functions, and we let you have as much money as you want. Today is the bad news. Today we impose a budget constraint and talk about how consumers actually make decisions realistically when they face a limit on their resources. And that's what we focus on today.

So let's start by talking about what budget constraints are, budget constraints. And let's start by talking about budget constraint construction. We're going to go back to our example of pizza and cookies. And in particular, for the next, I don't know, 19 lectures, we are going to make the critical assumption that your budget equals your income. That is, there is no saving or borrowing. You consume all your income, OK? We'll come back and talk about how people make savings and borrowing decisions later. Sadly, this is not a terrible approximation for Americans. The average American has less than $1,000 in available savings to access.

So actually saying your consumption equals your income is not a terrible approximation to the way most people in America have to live their lives today. But it's very important to remember, it's not what we're saying, people don't save and borrow. They do both. We're just going to leave that complication to later and assume that every penny you have you're going to spend on consumption goods. And in this case, it's just two consumption goods, slice of pizza and cookies.

So we're going to write your budget constraint as your income equals the number of cookies times the price of cookies plus the number of slices of pizza times the price of a slice of pizza. That is, your total spending on cookies will be the number of cookies you eat times the number of the price per cookie. Your total spending on pizza slices will be the number of slices you eat times your spending per slice. And that will add up to your income because you got to spend your income.

And that leads us to what we see in figure 3.1, which is the budget constraint, something you'll become very, very familiar with over the coming weeks. It's just a graph of this representation. The x-axis represents how many cookies you'd get if you spent all your income on cookies, which is your income divided by the price of cookies. The y-axis represents how much you'd get if you spend all your income on slices of pizza. What's your income divided by the cost of a slice of pizza? And the slope, critically, is the opposite of-- is the negative price ratio. Critically, the slope is the negative of the price ratio minus PC over PS, OK?

This is critical, and we're going to come back to why this is such a critical concept, the slope of the budget constraint. But let's start with an example. Imagine that your income is $24, that the price of cookies is $2, and the price of slice of pizza is $4. Imagine those are the parameters you were given.

Now, you might ask, where's your income come from? Where's the price of cookies come? Where's the price slices come from? These two things, we will tell you where they come from when we get to producer theory. We'll talk to you about how firms set these prices. But in consumer theory, we're taking them as given, OK? So for the consumer theory part of the course, for this lecture and next lecture, we take these things as given. We get to the producer theory, we derive where they come from.

Income comes from how hard you work and what are the sources of income you have. We'll talk about that in a few lectures. For the next couple lectures we'll take that as given. So for today's purposes you are given an income. You're given prices, and you have to decide how you're going to optimize your bundle given your preferences and given that budget constraint. And what's cool about this course, like I said, it's a layered course. We'll come back and tell you where all these things come from. But we go step by step to develop it. Right now, we take the step of those things as given, OK?

Now what this means is the slope of the budget constraint in this example is minus 1/2. So minus the price of cookies over the price slice of pizza is minus 1/2. That's the slope of the budget constraint. And we're going to call this the marginal rate of transformation. Remember, last time we had the marginal rate of substitution. This is the marginal rate of transformation. This is the rate at which you can effectively transform cookies and in a slice of pizza.

And this is not a course about alchemy. We're not going to teach you how to transform cookies into pizza. But given these prices in your income, opportunity costs dictates that every time you eat a cookie, you effectively are eating 1/2 fewer slice of pizza. Why? Because cookies cost half as much, and you have to spend your income. So you spend it on cookies, you're not spending on pizza, and vice versa. Every slice of pizza you have, effectively that's two fewer cookies.

So you're effectively transforming pizza into cookies and vice versa through the market, through the market. By choosing one, you're not choosing the other. That's why we're called the dismal science. That's the concept of opportunity cost. Nothing is free. Every cookie you have means less pizza. Every pizza you have means less cookies, OK? So that is exactly the application of opportunity cost.

So this is a difficult concept, I think. So I like to think about this in perhaps the best real-world example of how people can use budget constraints in their lives, which is Weight Watchers. You guys are all young and fit. It is amazing. We'll come back and talk about obesity later. It is amazing to look around this room. You guys are incredibly young and fit. You do realize that 1/3 of Americans your age are obese, 1/3, 0% of this class and 1/3 of Americans, something to just think about as we think about what's the role of the government in dealing with the problems of society to realize that we've really separated a lot between the haves and the have nots on many things, not just money, but also health, OK?

Let me ask you a question. How many of you guys drink calorie or noncalorie soda? OK. That is stunning. OK. That is stunning. 20 years ago, it would have been 100%, OK? It is really amazing. We've switched away from soda. We do all exercise, switched away from bad eating habits. It's just amazing. But only in the most educated populations has this happened. It's really quite striking.

Anyway, so for many people, struggling with your weight is an issue. And Weight Watchers has a program that's very effective. It's one of the few scientifically shown methods to actually lose weight. What does Weight Watchers do? They recognize that dieting does not work. Telling people eat this and eat that does not work. There is no evidence that any diet ever works, OK?

What Weight Watchers instead is establish a budget constraint. They say, look, we're not going to tell you what to eat. We're just going to tell you what each piece of food costs effectively in terms of weight gain. And we do that by assigning each piece of food a weight. So they say, for instance, a carrot has zero points. A Snickers bar has six points. And you just add up the points of what you eat up to the point total you want to hit.

They say, look, you tell us-- you can go on Weight Watchers and set it up for free. None of you have to, but when you're older, you can always set it up for free. And you basically say, what weight do you want to hit? And they say, OK, this is how many points you can have per day. Plus you get a cheat-- you get some cheat points. And if you consume those points per day within x weeks, you will hit your goal weight. But you decide how to do it.

So for example, let's say you go to McDonald's for lunch. And let's say your budget's 30 points, which is a pretty typical budget, OK? What that would say is for 30 points, if you go to lunch at McDonald's and you get a classic number one, that's a Big Mac, 14 points, fries 10 points, and a Coke which is 6 points. That's 30 points on lunch. You're done. Nothing else for the day.

On the other hand, you could say, well, wait, if I got a 10-piece Nugget, that's 12 points. Apple slices is 1 point. And a Diet Coke is 0 points. You've only used 13 points. Now, unless you have strange tastes, that's a way worse lunch. Who wouldn't rather a Big Mac and fries and a Coke than apple slices and chicken nuggets. Come on. But it's less than half as expensive in terms of weight gain. And you can make that decision. Some days you might say, screw it. I want a big lunch. I'll skip dinner. Some days you might say, I got a nice dinner coming. I'll have a lower calorie lunch.

But you decide because the budget constraint is laid out for you. And that's why it's the most effective way to lose weight because it empowers the consumer to not follow arbitrary rules but to follow their hearts within the constraint. It's basically what we're going to do in this class of constrained optimization. It says make yourself as well off as possible subject to a constraint. And that constraint is expressed in terms of the points assigned to food. So that's a great real-world example of how people can use budget constraints, OK? Questions about that.

OK. Let's now talk about what happens when we shock the budget constraint, when various things change to move the budget constraint around. Let's talk about how that works. OK. So for example, imagine prices change, OK? Imagine the price of pizza slices goes from $4 up to $6 a slice, $4 up to $6 a slice. What does this do to your budget constraint? Well, that's illustrated in figure 3.2.

Note the x-intercept does not change. Why does the x-axis not change? Because if all you're buying is cookies, nothing's changed. The only thing that's changed is if you want to buy a slice of pizza. Now, let's say you only want a pizza. Instead of being able to afford six slices on your $24 income, you can only afford four slices.

The budget constraint has pivoted inward, and the new slope, instead of being minus 1/2, is now minus 1/3. The opportunity cost of cookies has fallen. The opportunity cost of pizza has risen. And critically, your entire opportunity set has shrunk. You are worse off. Why are you worse off? Because the area underneath the budget constraint represents the full set of choices that are available to you. And that area has shrunken.

This is a critical insight. Remember, I'm going to overstate that term, OK, which is basically that your income hasn't changed. You've still got 24 bucks. All that's changed is price. Yet, you're worse off. You're worse off because your income is just a representation of what you can buy. And as the price goes up, you can buy less. So your opportunity set, which is the area under the budget constraint, has shrunk from the much larger area, including the light dots, to only the darkened area. So it's a shrinkage in your opportunity set because you can buy fewer stuff. Now, once again, that's irrelevant if all you like is cookies. But for everyone else they are worse off. So that's one example of how the budget constraint can change.

Another example of how budget constraint can change is your income can change, OK? Let's imagine, for example, your income decreases to $20. Let's say instead we'll go back to the original prices. But say your income goes from $24 to $20, OK? Well, what happens there is illustrated in figure 3.3.

Now, here it's a parallel shift in in the budget constraint. Why is that? Why is the budget constraint shift parallel as opposed to pivoting? Yeah.

AUDIENCE: The slope doesn't change?

JONATHAN GRUBER: The slope doesn't change, and why?

AUDIENCE: Because of the prices?

JONATHAN GRUBER: Yeah, the relative costs of pizza and cookies has not changed. The opportunity cost of giving up cookies for pizza is the same. It's just you can have less of both. So it's a parallel shift in in the budget constraint but once again a shrinkage in your opportunity set. You are worse off but for a different reason. You're worse off now for a more obvious reason, which is you have less money.

So two different changes. One change is one pivots the slope. One just is an inward parallel shift. Both reduce your opportunity cost, OK? In both cases, you are unambiguously worse off. You're worse off.

Now, you might say, well, technically in the first case, you're not worse off if you like only cookies. But remember, taste can change. Things can happen. You might someday want a slice of pizza. So we say you're worse off. Even if you're someone who chooses cookies, your opportunities have shrunk, so you're still technically worse off because you have fewer opportunities to eat pizza. Yeah.

AUDIENCE: Will this count if there is inflation [INAUDIBLE]?

JONATHAN GRUBER: So great question. So the question is like what happens if there's inflation, et cetera. We'll cover all that. Once again, we're going to go in steps. We'll cover inflation and what it does. But obviously, inflation would be like a price change. Now, what's interesting is if it's uniform inflation that would look like figure 3.3, right? If all prices go up constantly by a constant percentage, like figure 3.3, if its differential inflation, if cookies and pizza have differential inflation, it will look more like figure 3.2, OK? So what's going to happen is going to depend on the nature of inflation. Yeah.

AUDIENCE: If we're assuming that there are no savings, that all income was spent, why are we looking at the area below the curve?

JONATHAN GRUBER: Ah, great question. Great segue to the next point, which is, why wouldn't you always be on the line? And the answer is you would be, OK? The opportunity set is still a relevant concept because even if you're on the line, the line is lower. But you're asking a great point, which is why would you ever spend less than your income if you can't spend more than your income? And the answer is you wouldn't, OK?

So basically, now we come back to combining what we learned last time with what I just taught you. And we come to the fundamental tool of consumer choice, which is constrained choice. We said last time you want to have as much as you can. More is better. We said this time you can't consume more than your budget constraint. As this points out, as this question points out, that means you're going to choose a point in your budget constraint. In particular, you're going to choose the highest possible indifference curve you can reach given your budget constraint.

In other words, you will optimize at the point of tangency between your budget constraint and your indifference curves. And the intuition is just what this gentleman said. Higher indifference curves are better. You can only go as far as your budget constraint. Therefore, the best possible choice is when the indifference curve is tangent to the budget constraint. That's the furthest out you can get, OK? And we can see this in figure 3.4. Figure 3.4 is our first example of making constrained choice decision.

So what we have here is the budget constraint I laid out there and the utility function we used last time-- utility is square root of C times S, of cookies time slices, OK? And the budget constraints the one up there, income of $24, price of cookies $2, price of pizza $4. That is illustrated in figure 3.4. How is it illustrated? Well, how to draw the indifference curves. We taught you that last time, OK?

You know how to draw the budget constraint. I just taught you that. So you just draw both, and you find the one with the tangency. So the optimal choice is going to be at point D. That's the farthest possible indifference curve that can be reached given your budget. And this gives you utility-- point D gives utility of square root of 18. Now, once again, that number is meaningless. But it's useful in ordinal sense, which lets us ask, well, could we do better at another point?

So for example, take point E, OK? What would our utility be at point E? And why can't we have it? Someone raise their hand and tell me. Yeah.

AUDIENCE: It's the square root of 12.

JONATHAN GRUBER: No point E. I'm sorry. Square root of 32, right?

AUDIENCE: Square root of 32.

JONATHAN GRUBER: Yeah.

AUDIENCE: [INAUDIBLE] it's not on your budget.

JONATHAN GRUBER: Exactly. So Point E, square root of 32, you're happier, but you can't afford it. What about point A? This is on the budget constraint. Why don't you choose that point? Yeah.

AUDIENCE: Square root of 10 is less.

JONATHAN GRUBER: I'm sorry?

AUDIENCE: Square root of 10 is less than [INAUDIBLE].

JONATHAN GRUBER: Yes, so point A, you can afford it, but it's the square root of 10. Why would you want it? The point is, you can show yourself-- and then similarly point C would be crazy because then, as this earlier question pointed out, you're way inside your opportunity set. You're wasting money.

So the bottom line is you could show yourself graphically why the tangency is the best possible choice you can make, OK? Now, once again, I want you to understand this intuitively, graphically, and now mathematically. So let's do the math of constrained choice, OK? Always a risk when I start writing math on the board. So if I make a mistake, please don't jump down my throat. Just kindly point it out to me.

OK. All right, so basically, the key decision consumers make-- and this is one of the harder intuitions in economics. It's never about how much you have. It's about the next thing you might want to get. We operate in marginal space. We're always about not how many cookies do I have, but do I want another one? It's always about the marginal decision. We talked about marginal utility and marginal rate of substitution last time. It's always about what is on the margin? Should I be moving in one direction or another?

And basically, if we said that the equilibrium is the tangency, what's the slope of the indifference curve? The slope of the indifference curve is the marginal rate of substitution. We derived that last time, the marginal rate of substitution, which is minus Mu C over Mu S.

Now, if that's tangent, that means that it's equal to the marginal rate of transformation at that tangency. We define the marginal rate of transformation as minus PC over PS. And that leads us to the fundamental rule of consumer utility maximization, which is set Mu C over Mu S where marg util is equal to price ratios.

Utility is optimized when the ratio of marginal utilities equals the ratio of prices. We didn't have to think about-- we don't go and think like, well, let's take a slice of pizza. Let's take 10 slice of pizza. No, we say at the point we're at, how do we feel about incrementally trading pizza for cookies, pizza for cookies? That's the way to think about the decision. Don't think of it like do I want eight slices of pizza or five cookies or whatever? No, don't think of it that way. Think from where I'm at today, do I want to move in one direction or another? And the answer is you always want to move in one direction or another until you get this equality. And if not you're not optimizing.

Now, basically, this kind of-- the fundamental rule will do when we do this constrained choice in economics is we're always going to in general be setting marginal benefits equal to marginal costs. That's how we make decisions in economics. For every decision, we set the marginal benefit, that is the incremental benefit of a decision, equal to the marginal cost, the incremental cost. And that's expressed here. What's the marginal benefit? What is the marginal benefit of the next-- what's this ratio? This is saying how much is the next cookie worth to me, to me, relative to pizza slices? And what's it going to cost me relative to pizza slices?

The marginal benefit is how happy I am with the next cookie in terms of how much pizza I have to give up. The cost is how much do I have to spend for the next cookie relative to what the next pizza is going to cost? Now, I find-- I find this a hard formula intuitively. I like to rewrite it for my own intuition in this way. I like to transform it and write it as Mu C over PC equals Mu S over PS. And I call this a bang for the buck equation.

Think of it as you want to consume pizza and cookies until the ratio of your happiness from each good to the price of that good is equal to all the other goods. It's your bang for your buck. Your bang is your marginal utility. Your buck is what it's going to cost you, OK? Different ways of thinking about it. And once again, this is something you need to spend some time on.

So let's think for a second about why this rule makes sense. Imagine you are in a place like-- you're on a place where the marginal utility of cookies over the marginal utility of pizza is greater than the price of cookies over the price of pizza. Can anyone tell me what point on this graph would illustrate that? Of the labeled points, which point would illustrate that disequilibrium and why? Which point illustrates a higher marginal set of marginal utilities than prices? It's a hard question. Can anyone get that one? Yeah, go ahead.

AUDIENCE: Would it be C?

JONATHAN GRUBER: And why would it be C?

AUDIENCE: Because we have little of what we want.

JONATHAN GRUBER: So that's a great-- it's not right, but a very illustrative wrong answer because that illustrates why we want to do marginal thinking economics. You're saying, well, point C is screwed up because we want to spend anything we have. Well, that's irrelevant. It's about the marginal decision. It's about the next cookie versus the next slice of pizza.

So it's not point C, OK? It's, in fact, not point D or E because that all of those points, this ratio holds. At point C, D, and E, this ratio holds. At all those points you're going to get those being equal. It's either point A or B. Anyone know? 50% chance. Yeah.

AUDIENCE: A because the slope-- the negative slope of A is greater than the negative slope of [? C. ?]

JONATHAN GRUBER: Exactly. Because at point A the indifference curve is cutting the budget constraint from above. So it's a steeper slope. So this number, this absolute value is larger than this absolute value. It's cutting it from above. So it's a steeper slope of the indifference curve than the slope of the budget constraint. So here's how to think about reestablishing equilibrium, OK? What that says is-- let's say this very precisely. Listen it's very precisely.

At point A-- it's so important I'm going to read my notes, OK? The rate at which you're willing to give up slices for cookies is greater than the rate at which the market's demanding you give up slices for cookies. So that is, the marginal benefit to you of another cookie in terms of slices is greater than the price to you of another cookie in terms of slices.

So in other words, at point A-- so let's show this mathematically, OK? At point a, at point A, what's the marginal utility of cookies? Well, we use to say math we used last time. Utility function is square root of C times S. So what's the marginal utility of cookies? The marginal utility of cookies is the derivative of this with respect to C. So it's 0.5 times S over square root of S times C.

At marginal utility of pizza slices, 0.5 times C over square root of S times C, that's our formulas. At point A, you have two slices of pizza, OK? So this marginal utility you have two slices of pizza. So this is marginal utility is 1 over square root of 10. And you have five cookies. This is marginal utility is 2 and 1/2 over square root of 10.

So the marginal utility, so the marginal rate of substitution at this point is minus 2.5. What does that mean? That means you would like, you'd be willing to give up 2 and 1/2 slices of pizza to get one cookie. You have so few cookies at point A that you're willing to give up 2 and 1/2 slices of pizza to get one cookie. Let me just pause there. This is from last lecture. People understand that. Given your preferences-- yeah.

AUDIENCE: I'm a little bit confused on where you get square root S times C.

JONATHAN GRUBER: The square root of S times C, it's derivative of this. It's just the derivative formula. The derivative of square root of C times S is 0.5S times-- well, I wrote S times C. It's C times S. Doesn't matter. But it's the derivative formula. Once again, I said I don't require 1801, but you do need to know basic differentiation and stuff. So I still don't know it. It's always good to review it, OK? Other questions.

So what this is saying is your preferences are such that you would be willing to give up 2 and 1/2 slices of pizza to get a cookie. But here's the question. What does the market tell you you have to give up? How many slices of pizza do you have to give up to get a cookie in the market? How many? How many slices of pizza do you have to give up to get a cookie?

AUDIENCE: Two.

JONATHAN GRUBER: Someone raise their hand and tell me. How many slices of pizza do you have to give up to get a cookie? You guys are so afraid of getting it wrong. You know this. Someone raise their hand and tell me. Yeah.

AUDIENCE: A 1/2.

JONATHAN GRUBER: A 1/2 because cookies cost $2 and pizzas cost $4. So you're saying, I would give up 2 and 1/2 slices of pizza to get a cookie? The market's saying, you know what? You only have to give up 1/2 a slice of pizza to get a cookie. So what are you going to do? What are you going to do? Buy more cookies and less pizza. The market is saying you can move in a direction that makes you happier. You can move in a direction that makes you happier because right now you're willing to give up a lot of pizza to get cookies. But you don't have to. You only have to give up 1/2 a slice of pizza to get cookies.

The marginal rate of substitution is greater, is greater than the marginal rate of transformation, which is minus 1/2, OK? The marginal rate of substitution is minus 2 and 1/2. The marginal rate of transformation is minus 1/2. That's why the slope of the indifference curve is steeper than the slope of the budget constraint. Therefore, you are willing to make trades the market is happy to let you make. And so you should move, and you should continue to do that. You'll see by that logic, you will continue to do that until you come to rest at point D.

Now, given my bad handwriting, I'm not going to go through the opposite case. I strongly urge you to go home right away while it's still in your mind and redo this for point B. And show yourself that you get the opposite conclusion. At point B, you will find that you are happy to give up a lot of cookies to get pizza. Well, shit, the market says that's a great deal. You only have to give up two cookies to get pizza. You're going to be happy to give up lots more than two cookies to get pizza. So you'll move back to the middle again.

So there is pressure-- the disequilibrium between the marginal rate of substitution and the marginal rate of transformation leads to pressure to move to the point where they're equal. There's a natural equilibrating mechanism, which is the difference between your preferences and the market's prices will drive you to equalize those. And that's it. That's how we make all decisions ever.

I've now explained the entire process of human decision making to you. Ignore psychology. I'm just joking. But actually, the truth is, once again, this simple model we learned in a lecture and a half-- remember, the last lecture was short, so really a lecture and 1/4, OK-- can explain probably 90% of everything consumers do. It's an incredibly powerful tool. Yeah.

AUDIENCE: Where did you get the negative 2 and 1/2?

JONATHAN GRUBER: Oh, the marginal substitution, remember, is the negative of the ratio of marginal utilities definitionally. Marginal rate of substitution-- so it's the marginal utility of cookies, which is 1 over square root of 10 over the marginal rate of slices, which is 2 and 1/2 over square root of 10 and a negative sign in front of it because it's definitionally negative.

AUDIENCE: Would you get [INAUDIBLE] 2 and a 1/2 though?

JONATHAN GRUBER: The marginal--

AUDIENCE: You'd do the marginal utility of the root number of [INAUDIBLE].

JONATHAN GRUBER: What did I do wrong here?

AUDIENCE: Wouldn't it be 1 over root 10 over--

JONATHAN GRUBER: Oh, you know what I did wrong? I did this wrong. The number-- remember, we have-- here, we have-- how many slices of pizza do we have at point A? We have 5 slices of pizza. So this is 2 and 1/2. Good catch. That's 2 and 1/2, and that's 1.

That's the mistake, which is I put in the wrong number of slices of pizza. I inserted here-- you should insert here the number of slice-- good catch. This is 5. This is 2. So I inserted the wrong numbers there. So the ratio is right. I just got these wrong in the marginal utility calculations. It's a good catch.

OK. Other questions. And once again, please speak up on those things, OK, because now look at all the people you've helped. You're a giver. OK.

AUDIENCE: [INAUDIBLE]

JONATHAN GRUBER: You're welcome. OK. Other questions about that. OK. Let's do an example. And for the example I want to come to one of the most important social programs we have in the United States, which is the SNAP program, Supplemental Nutrition and Assistance Program. Traditionally, when I was a kid, it was called food stamps. It's basically the program in the US that gives resources to people they can use to buy food.

Essentially, the way this program works is if you're poor enough, we give you a debit card. And that debit card had a certain amount of money on it that you can use to buy food. And the way it works is when you go to the grocery store, there's certain items that the debit card will ring up for and certain they won't. So if you take a SNAP card and try to buy a magazine, it won't ring up for that. You can only use it to buy food. It used to literally be you'd get stamps, and you'd have to embarrassingly hand them to the cashier. Now it just looks like a regular debit card. The difference it can only be used on certain items.

And basically, roughly speaking, in the US we have something called the poverty line. We'll come back and talk more about this. The poverty line is what we assume is the minimum standard above which you need to have to live in America. It's embarrassingly low. We say the poverty line for an individual is about $14,000. I don't know how anyone would live in Boston on $14,000, but whatever. But that's the poverty line.

And basically, if you're below the poverty line or a little bit above it, you get a couple hundred bucks a month in food stamps, on your debit card. Now, what I want to do is ask the following question. Why do we do this? Why don't we just give people cash? If we want poor people to have money, why don't we just give them money? And so we're going to analyze the answer to that question, not through introspection, but through economics.

So what we're going to do is talk about how SNAP operates relative to giving people cash. So to do this, let's go to figure 3-5A. Let me walk you through this figure. This is multiple things-- if I had a projector, this would be done in animation. There's multiple things going on in this figure.

We have an original budget constraint. Imagine someone has $5,000. Imagine where someone has an income of $5,000. They're very poor, and all they could spend their money on-- all they could spend their money on is either food or shelter. Now, once again, you might say, well, gee, don't they need health or whatever? Leave that alone. We're in a too-good world. You can make this three-dimensional in your free time.

So basically, think about a simple world where people have $5,000 of income, very poor people. And all they can spend it on is food or shelter. And they spend all their income, of course. So their original budget constraint looks like the line that's labeled original budget line. What I'm going to do is I'm going to assume that the price of food equals the price of shelter equals 1. This is a trick we use in economics or in mathematics in general. It's called the numéraire good.

We don't want prices to mess up the math, so we just set the prices to 1. It doesn't do any harm. It's generalizable. And this way you could think of dollars as quantities. So think of the amount you spend as the quantity you get. And since food and shelter are vague concepts anyway-- I haven't defined what food is. It's a basket of food, and shelter is a basket of living arrangements. No harm setting the price to 1.

So basically, the ratio-- the slope of the budget constraint is minus 1. We set these prices to 1 for some vague concept called food and some vague concept called shelter. We set the prices to 1. We have a budget constraint where the intercepts are at $5,000 on each axis because that's all the money you have. And the slope is minus 1. Once again, any question along the way, shout out, raise your hand.

Now, imagine the government decides-- and this graph is not to scale. I'll say that right up front. The government decides they want to give every poor person $500. They want to give every person $500, every poor person $500. So for this person, what that means is they are now richer. Their opportunity set is expanded. Their budget constraint is shifted out in a parallel fashion. Prices haven't changed. They're just richer. So the budget constraint has shifted out from $5,000 to $5,500. Once again, not to scale, but it allows some space to illustrate things easily.

So the new budget constraint is at the point-- it is the same slope but the higher intercepts. Now let's talk about two different people and the choices they make. Person x likes shelter and doesn't care much about food. Once again, we can't judge preferences. Preferences come from some innate psychological basis. It turns out psychology does matter, OK? We can't judge preferences, but their preferences are such that they don't need to eat a lot, but they really want shelter.

So originally, they spent, of their $5,000, they spent almost nothing on food. They spent $4,800 on shelter and $200 on food. Person y, on the other hand, doesn't care much about shelter but really needs to eat. So they spend only $100 on shelter originally and $4,900 on food. Now, what happens when you give each of them $500? Well, I'm not going to go through the math.

These are actual choices and actual utility functions. I'm not going to do the underlying math of this. But given these preferences, person X chooses to say, look, I love shelter. I'm taking $400 of my $500 bucks and spending on shelter. So I'm going to go from $4,800 bucks in shelter and $200 on food to $5,200 bucks on shelter and $300 on food. Once again, that is mathematically consistent with a set of preferences. There are a set of preferences that deliver that outcome.

Person Y says, look, I love shelter, so I'm going to spend most of my new money on shelter. So it just reinforces their preferences. If you will, they get wider apart. They're both better off, but they're more different in their choices, OK? Questions about that. Now is the hard part.

Imagine the government says, you know what, poor people? We're not giving you $500 in cash. We're going to give you a $500 debit card that you can only spend on food, not on shelter. How does this change your budget constraint? Here's the hard part, OK? We start with the same original budget in figure 3.5B.

But now, it's different than giving the $500 in cash. And why is that? That's because for the first $500 in food, there is no opportunity cost in terms of shelter. If you spend-- you can get the same amount of shelter-- you can get the same amount of shelter if you spend $100 on food or $200 on food or $500 on food. So the budget is now flat from the y-axis to the point x2. It's flat, and then it rejoins the original budget constraint.

Why is it flat? Because think about it. All those points on that flat segment are now the feasible points. If you want $5,000 in shelter-- before, if you wanted $5,000 in shelter, you couldn't have any food. Now you can have up to $500 in food and still have $5,000 in shelter. The budget constraint is now flat and then rejoins the original budget constraint at that point x2, OK? We're going to practice in section these kind of piecewise budget constraints. This is hard to do, but you get good at it.

Now, let's ask, what effect does that have on people's choices? Well, let's start with person Y. We've just said to person Y, we're going to give you $500 that you can only spend on food. Yet, it has the same effect as giving them cash. Why? Why for person Y is there no difference between the two panels, even though we've given the debit card they can only be spent on food? Why is there no difference? Yeah.

AUDIENCE: Because their marginal rate of substitution for food versus shelter is the same, and they'd rather keep the [? additional ?] money on food anyway.

JONATHAN GRUBER: OK. That's partly right, but you've got the basic idea. The important point is-- the important point is the second part of your sentence. They're already spending that money on food anyway. And money is money. So they can just say, fine, I'll take $500 out of spending on food. I'll call it SNAP, and I'll replace it with $500 more I can spend on something else.

Money is fungible. As long as you're spending more than $500 on food, if I give you $500, it must be for food, you're like, whatever. I was always spending $500 on food. I'll just relabel it, OK? It doesn't affect my choices. Yeah.

AUDIENCE: So they can spend it on something different for food or shelter.

JONATHAN GRUBER: No, no, no, no. They'll just spend it on-- in other words, the point is think about when we give them cash. This is confusing. When we give them cash, they say, great, you give me $500 cash. I'm going to take my consumption from $4,900 to $5,100 of food. I'm going to take my consumption of food, I'm sorry, $4,100 to $5,100. I'm taking my consumption of shelter from $100 to $400.

Now I say, oh, no, you have to spend it on cash. You're like, fine, I don't care. I'm still going to spend $5,100 on food and $400 on shelter. I'm just going to label $5,100 SNAP. But nothing else has changed. It's just a labeling thing, OK?

Now, think about person X. They can't pull off that trick. Why? Why is person X-- person X now has to make a different choice. Instead of choosing what they wanted, which was x2, they now have to choose x2 prime, which is where a different indifference curve hits that kink, where I3 prime hits that kink. Why? Why do they have to make a different choice? Yeah.

AUDIENCE: Because they want them to spend that money on shelter after the new $500 are allocated.

JONATHAN GRUBER: They can't. We're not letting them. So what has happened is by constraining this money to be on a debit card rather than cash, we have changed their choice from what they wanted to do, which is $5,200 in shelter and $300 in food to now $5,000 in shelter and $500 in food. We forced them to have less shelter and more food. And what have we done to their well-being? Are they better off or worse off? Tell me why. Someone raise your hand. Tell me why. Is person X better off or worse off when we constrain their choice? Yeah.

AUDIENCE: They're worse off because now they're in a different curve.

JONATHAN GRUBER: Exactly. More is better. They're in a lower indifference curve. They are worse off. By constraining their choice, we've made them worse off. Definitionally, by giving people something other than cash, we make them worse off. But we do it anyway. And to see why, let's think of a simple change to this diagram, which represents the way policymakers think about poor people.

Cross out-- on the y-axis, cross out the word shelter and put in the word cocaine. Basically, policymakers think we can't give these guys money because they'll just spend it badly. They won't spend it on things we want them to spend it on. We want them to spend it on food. We're going to force them to spend it on food to make sure they don't waste it. Policymakers think, look, there's a third option, which is cocaine or alcohol or whatever, and we don't want them spending money on that. So we are going to force them to make sure they have the food.

So that is why we have these kinds of what we call in-kind benefits. Indeed, as I'll teach you later in the semester and as I spend a whole section of my course 1441 talking about, the US government redistributes in goods vastly more than in cash. The amount of money we give poor people in goods is something like 10 times the amount of money we give poor people in cash. Between medical care, housing, and food, those programs add up to about 10 times of how much money we give people in cash, maybe 5 to 10 times, OK, because of this exact problem, because we think that we know better. Government policymakers think that we don't want to give people cash and worry what they spend it on.

So this raises the natural question of-- actually raises two questions. One is the positive question of what effect does this have? That is, how much more food do we get people to eat by giving them debit cards rather than cash? You don't know the answer from this graph because maybe everyone's like, why? Maybe no one's affected by this. Maybe everyone-- so maybe the answer is zero.

The answer is-- and we've done this from experiments. We basically convert-- we'll talk a lot about in this course about experiments on economics. And really a pioneer in that field is our Nobel Prize-winning couple of Esther Duflo and Abhijit Banerjee. They've pioneered the use of wide-scale experiments in economics. One such experiment was run to actually randomly give some people cash and some people food stamps.

And what they found was it does-- I'm sorry, SNAP. Giving SNAP does increase consumption of food. That is, there's enough X's out there that on average, for every dollar you give in food stamps rather than cash, you get about-- sorry, SNAP. Sorry about that. For every dollar you give in SNAP rather than cash, you get about $0.15 more in food consumption, not $1. There's some people like Y. But basically, I have all the X and Y's. By giving people SNAP instead of cash, you do change their consumption behavior, OK?

So the positive question is, is SNAP having its intended effect? The answer is yes. The normative question is, should we do this? Should we force people to take their good in-- take their goods in food rather than cash? And here, once again, we come to the value of experiments. It's a hard question to ask, but this is where experimental economics, once again, is pioneered here.

And by their third Nobel Prize winner, Michael Kremer, who's now in Chicago. Duflo, Banerjee, and Kremer set up something called J-PAL, the Jameel Poverty Action Lab. It's in the Department of Economics here at MIT. It is now the preeminent organization in the world for using experiments, like real scientists do, to actually answer economic questions, to basically say, if there's an interesting economic question we want to answer, let's answer it by randomly running an experiment.

So for example, J-PAL has now run dozens of experiments with the experiment with giving people in developing countries cash. They mostly focus on developing world, OK? Giving people in developing countries cash versus giving them goods. And the answer seems to be that basically we should give people cash, that basically give people cash, very little of it gets spent on bad things. Almost all of it gets spent on education for children or food or shelter.

But moreover, giving very poor people cash allows them to make investments to escape poverty. So what they did is they took a group of poor women in Uganda and gave them $150. You might think, wow, big deal, $150. That is 50% to 100% of the annual income in Uganda. Let's be clear, OK? About half the world lives on less than $2 a day. So $150 is big money in Uganda.

What they found was-- and they gave some women that, and they randomly gave other women did not give them the money. What they found is 18 months later, the women who had gotten the cash had raised their earning, had doubled their earnings. Why? Because they used that cash to set up little shops, to buy a cow, to invest in how they could make more money.

So not only do they spend very little of it on things you might consider bad, they used it in a productive way we didn't even foresee to invest in their own futures and get better off. There's a recent experiment in-- gosh, I don't remember what it was. You might have read of where they gave homeless people in the US $7,500, a small sample of homeless people, like 60 homeless people. And they found that, once again, they spent most of it on getting their lives back together, not on dangerous goods.

It's not to say that we shouldn't worry about people consuming dangerous goods. We'll talk a lot about this semester. It is to say that when we want to make a decision in economic policy, we look to the evidence. And the evidence is, A, the positive evidence is, A, giving SNAP cards rather than cash changes people's behavior. And B, they seem to be better off if we give them cash. And that's how we use the tools of economics to make informed policy decisions, OK?

Let's stop there. We'll come back next time and talk about more about putting this all together. First problem set is handed out Friday. It is due in two weeks because we have no section next Friday, at 5:00 PM in two weeks on September 30.