EEP100: Lecture 6 (Sep 15, 2009)

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Welcome back to a fabulous Tuesday.

I've got the printed out version of this optimization example that I sent you on an e-mail. It's more clear than what I wrote on the board. And you're going to be doing more math in this week (like the gradient, or the slope of math that you're doing this week) is going to be the steepest of the entire semester. So don't freak out just yet. If you do freak out, then this is going to be your biggest freak out. Once you get ahold of constrained optimization, you've pretty much gotten all that you ever need to know for the math of economics.

That doesn't mean that someone won't try and teach you more math in economics, it just means that it's all you need to know. Are there any open questions about anything?

[When will you post the Youtube link to the other lectures?]

I am doing whatever I can. I have massive technological stupidity. So we just figured out this two hour video thing only last for an hour before it decides to shut itself off. We'll get there. The mp3…that's all logistical stuff…someone had a problem downloading the mp3.

[Yeah, that was me, that's why I was asking for…]

It should…I just went and looked at the last two lectures, and it seemed okay. So if you have a problem with the mp3, send me an e-mail and I'll send you a direct link.

[Are homework assignments going to be posted to b-space?]

Yes, the homework assignments will be handed out on Thursday and they'll also be posted on b-space for those people who lose things quickly. And they'll be due a week from Thursday. And that's going to be a bunch of constrained optimization problems. We went over them yesterday; they're very good. So you guys will have fun with that. Homeworks should be…neat. I think that's all I'm going to say. I'm not going to say it needs to be typed or anything like that.

[So what are you doing with the walkout, since that's…]

The what out?

[The walk-out that they're doing?]

Who's walking out? Am I?

[I was asking if you were, because a lot of faculty…]

Whatever. Is this like a union thing?

[There's a UC-wide walk out on September 24 because of budget cuts.]

I don't give a shit; I'm going to teach. Any other questions? I'm going to lose my job in a year anyway, I don't care.

So, we did the homework.

[Did you just say homework? When will we get it?]

You'll get it on Thursday. It's due on the Thursday after that.

[Sorry, I didn't hear you.]

It's alright.

If anybody wants a job transcribing these lectures from either the mp3 or the video, send me an e-mail. If you don't know my e-mail, its dzetland@gmail.com. It looks like at a rate of about $12 an hour. You're going to get like $30 a lecture. So if you want to make about $1000 this semester, send me an e-mail. And if I get e-mails, then we'll have transcription. And then it can be translated into Hebrew and all kinds of cool stuff.

And other questions? Open questions?

[The syllabus says the books are due on the 18th, but on b-space it says the 15th.]

Finish the books. What does it say here now…I have problems with synchronizing my syllabus with the calendar, and it's me that's the problem, but finish the books by September 18 (is that this week?). Yeah, by the end of the week. It's a rough deadline, okay? It's not like there's going to be an exam on this book, but I just want to give you an idea that you should be finished by now.

So, it says 18th on the syllabus and 15th on the calendar? I'll fix the calendar. Just finish the books this week. Is anybody having issues with that? Hopefully not. Did people like the books? Did you like the books?

[Some parts of it]

Some parts of are interesting. Yeah, you know, what are you going to do with 300 examples? Anybody else need this constrained optimization? No? okay.

The economics in one lesson could maybe be one chapter. But it was free.

[He talked about the first sentence for the first two pages. Why am I...]

How much did you pay for the book? Marginal cost, marginal benefit. It's not very much, I hope.

Any other stuff on the books? Questions on that?

Any other questions? Anything like that?

[Wait, so for the blog, we just e-mail you.]

Yeah. Plain text. Links. By the 1st. Before the 2nd.

[Can we comment on any of them, or…]

Here's the thing. It's going to be a bit of a scrum I think. So I'm going to be posting about two or three of your blog postings everyday on my blog. It's going to be like randomly showing up everyday in random order. You don't have to do anything. You can say, "My job is done." But I really encourage you to read each others' posts and comment on them. And, most importantly, point out the weaknesses.

There's a thousand people that read my blog already, so they will be commenting. So I want you guys to learn from it. This is, in a sense, why the workload might seem to be low. We're only having three homeworks, only one midterm, because I want you to put more time into this writing, into learning the dialogue in what's going on with just the blog, but also with the rest of the world.

Does that kind of answer your question? It's not obligatory, it's just if you want to learn, right? If you don't want to learn, I don't know why you're in the university. Although some people just want to get a higher salary, apparently. Let's see here. I'm really being snarky today.

So I wanted to finish up some old business and then get to the new stuff. So just as a point of interest, remember that markets don't solve…

Did I do this Venn diagram already? Let's call this "markets", "no markets", "missing markets". So I don't know exactly why it's a Venn diagram…

I think the idea of the overlap between these things is that somehow, some goods can move from a missing market scenario to a market scenario. This is the idea of a pollution tax, for example.

The idea of a market is beer or chips or whatever. Pay a price, you get the good. and when you buy the good, you pay the full cost of producing that good, okay?

So when you go to the farmers market and you buy a tomato, you pay the full cost of the tomato. It's the labor, it's the fertilizer, it's the land rent, it's the water, it's the transportation. All of those things go into the cost of that tomato, and you pay the price of the tomato. And your consumption of that tomato is appropriate from that social point of view—a social welfare point of view.

Now, if you start to think, "Oh what about agricultural runoff, or pollution from machines, or fertilizer production…"—fertilizer's produced with what? Does anybody know? The big energy input to make fertilizer?

Say it loud, say it really loud.

[Petroleum]

Not petroleum, exactly. Natural gas. But energy. So the old fertilizer was cow shit, then it's bat shit, and then they went to artificially produced fertilizer. That's why it uses a lot of…

And that's huge in the argument about ethanol, for example. The biggest part of the ethanol footprint is the fertilizer that goes on the soil to produce the corn. It takes energy to make energy. My point is that if all the prices are appropriate on the input side, and you purchase the tomato at the market, then you are buying the correct amount of tomatoes for the correct price.

But what if there are costs that are not included in the price of that tomato? The price of pollution, right? Maybe there's slave labor involved. Something like that. In that case, we have what's called a missing market, in a sense that the price is wrong. Usually, the price is going to be too low. The price can potentially be too high, for example, if the University of California says that we're going to put textbooks on sale for 50% off today, but the queue to get into the store is 600 students long. The price that you're paying is not just the cash price, but it's also the price of the time.

So missing markets, the price that you pay is not including the total cost of that good, from a social basis, and potentially from your individual basis.

[So does that mean that we can move the tomato into the missing market?]

Well the tomato is supposed to be in the market right now, but can we move it… we might want to move, for example, driving around, which produces pollution, from a missing market (we have a missing market for pollution) we want to move that into the market for pollution by having a pollution tax, right? A gasoline tax. Or a pollution permit, which is supposed to be the equivalent, but it may not be sufficient, okay?

But then there's this thing called no markets, and if you remember, the first day in class. I said that we've got man plus a woman (woman plus a man). Is it equal to love, right?

Money can't buy you love. There isn't necessarily a market for a lot of things that we value. And so economics can't necessarily colonize this part of our life right now. But there are times where markets just won't work. That's the idea of the market. And the idea is that you want this to be a complete Venn diagram of the world.

Now if you go from no market (can money buy you love) into a market. What would that be for…literally…for sex. What's that called?

[Prostitution]

And maybe, when prostitution is illegal, it's a missing market. Right? Because you want to have it, but then it's highly regulated to the point of being illegal, so then you have all kinds of crime. What I'm saying is: you can move between these circles, and if you're in one circle, you want to see should you be in the other, or could you be in the other, and what's the cost of moving back and forth. A lot of economists say we can fix a lot of our problems by just putting a market on it, and that can be true; can also be false.

[Can you ever be in-between markets?]

What's an in-between market? What are you thinking? Or just hypothetically?

[I'm just looking at the Venn diagram and I don't understand the spaces in between]

So here's the space, I guess let's just call this one here "sex". Because sex can either be in a market (a market for prostitution in Nevada or in the Netherlands); it can be a missing market, because it's a black market in Oakland, or whatever; or it's a no market (which is like down at the pub, where you have to be much more persuasive.)

Other questions about this?

[I'm just confused…how can you be in a market and no market at the same time…?]

No, I'm saying…it's not at the same time. But the same good might (in some places) be in the market and not be in the market in a different place. So the sex example…you might have sex that's in the market in Amsterdam, but is not in the market in whatever (like I said, in Oakland). It's the same good, but it could be a spatial problem. Or it could be a temporal problem. It's a different place.

So it's not quantum economics that we're doing here.

[Well I guess, in terms of externalities, then is anything a market?]

An externality would tend to fall in the missing market.

[Well, right, so then…would anything really fall into a market?]

Oh, if the world is full of externalities, then maybe there isn't, right? So if you have…

Say that I've got a pen and you've got a pen, right? And they've already been produced. All the costs have been taken care of. And we swap pens. That, in a sense is a market transaction, there's no externalities produced, because the production of then pen has already occurred. So in a sense, used goods can be a perfect…they can be called goods as far as markets are concerned. The price has been paid or avoided.

Other questions?

[If you swap pens, aren't you in the "no market" section?]

No, it's just barter, but it's a market transaction. "No market" means you can't get it at all. Like the Beatle's song about love.

That was meant to be an overview that I should've said a long time ago. Let's go over elasticity again, because when people come to office hours and they say, "I don't get it", I say, "Oops, I better do a better job next time."

So I'm going to use this screen here, actually. I'm going to put up that diagram that we had for the linear demand curve and talk about how elasticity changes, just for clarification.

Today the labeling axes are going to be very important. So start paying attention to that. So elasticity at point A for this good is what? More elastic or less elastic? What is the formula for elasticity? Change in quantity, change in price, price, quantity.

What's it at A? What's the elasticity? Price elasticity is what? Higher is…higher meaning zero or higher meaning infinity?

[One]

One. That's in the middle. Anyone?

[At A?]

At point A.

Price elasticity is infinity, but not just infinity, negative infinity, right? Because it's price elasticity.

Over point C, what is it? This should be easy now.

[Zero]

Zero, okay? So basically, what we're doing here…(and at point B is at one, as was told to us in the second row, here.)

What we have is this range here of elasticities. And you're going to have that as you move along this demand curve, okay?

And it's weird because we think, it's just a line, so it'd be quite simple. But the problem is this Q. As Q goes to zero, it's in the denominator. As Q goes to zero, the elasticity goes to infinity. And what's the intuition behind that?

[Why is it negative?]

Because we're talking about price elasticity, right? What's the law of demand say?

[As quantity increases, price goes up.]

Okay, so that's an inverse relationship, right? So as the price goes up, you demand less. That's why it's minus infinity. That's a good question.

So let me…just as a pet peeve…a lot of people (professors, or whatever) they'll say, "elasticity for bananas is 0.5". But it's really minus 0.5. And they get into this elaborate explanation of why we use absolute values or whatever. But really, just to keep it straight, it's negative. And if the price elasticity is positive, it means that if price goes up, you'll buy more. And that kind of works with rappers and bling, but it doesn't work with reality.

So the idea is that there's a range of elasticity. And the range: you're going to be moving from zero to minus infinity. Is that clear enough? Is that clearer than what you guys saw last time? There will be a question on this, so you're paying attention. On the exams and the points and the grades and all that stuff.

And just as a point of notation, because Fei is trying to be clear, and I'm going to help him be clear…is that the elasticity in this range here is in the set of minus infinity to one.

The elasticity in this range here is in the set of minus one to zero. Now you will see that I'm using a combination of curved brackets, parenthesis and square brackets. This is a mathematical notation for sets, and I'm putting it up here because it's going to come up in your homework (or it might, or it might not). But it will come up in the future. Basically, if it's a round parenthesis, it means that it doesn't include this number here. It doesn't include minus infinity. You can never include minus infinity. Infinity is too big. And it also doesn't include minus one. Why doesn't it include minus one in terms of this elastic range? Why doesn't it include minus one in that elastic range?

[Because minus one would make it unit elastic?]

Perfect answer. Minus one is right here. So in the elastic range, it's everything from minus one to minus infinity. In the inelastic range, that minus one is there. It's unit elastic and it has a square bracket on zero, which means that you include zero. Zero is perfectly inelastic. That means there is absolutely…when the price changes, how much does your demand change?

[Same exact amount?]

It doesn't change. Same exact amount. Your demand is set. You're inelastic. Is that useful?

That's elasticity. And also, let me point out. There's some question about…if you're at point D here, it kind of makes sense that as the price drops, you're going to demand a lot more. You've got a very elastic response. But if the price goes up, do you demand a lot less? Does demand drop by a lot? It's kind a strange idea to think about—the price goes up and your demand drops by a lot. It drops. But the whole point is that you have strong reactions to price changes in this range.

"Strong reactions" is what I want you guys to understand. You have strong reactions to price changes in this range because you're very sensitive in this range. And you're going to pay a lot attention to price, but you're not going to…that's what I'm trying to say. You're going to have a strong reaction to price. It's kind of counterintuitive to say…it makes sense to say: your price drops you're going to demand a lot more. Because you've been pushed to the wall of almost no quantity. If the price drops, you're going to demand a lot more. That makes sense. But if the price goes up, you're going to demand a lot less, but that doesn't really make sense because, you're like, wait a second, I thought I was really sensitive right now.

But you're going to have a strong reaction, that's what I'm trying to say. You're very sensitive. And it's…I cant even get the idea around my head right now. But keep in mind that as you move in this reaction, you're having stronger and stronger…oh that's it.

You're having a stronger and stronger utility response in terms of how many goods you have. Your utility is being impacted very, very strongly because there's less and less of the good around. I'm not going to ask you to write an essay on that, but I want you to think about that. Mostly the idea of…you're in the dessert, you have one gallon of water, you have half a gallon of water. You're really starting to pay attention to the water the

less you have, okay? That's the end of elasticity for the time being. Any questions on that?

And on a similar note, inverse demand was very confusing for some people, so I'm going to step back for a second and go over that. I want you guys to have a really strong grasp of the principles, and that's why I'm going over this and beating on some things that might seem a little bit weird or pedantic. But if we're doing economics, then you will almost…who's going to take another class after this one, assuming I do my job right?

So I want you to have a strong intuition, and methodological abilities, so that when you see more and more economics as time goes by you're not confused, you're actually learning it. So here's the thing. We think that the quantity demanded of the individual, as opposed to aggregate quantity demanded, which is big Q, is a function of price. You go to the store, and you look at a CD or a quart of milk. You pay attention to what the price is. When we graph it, now let's just take an example here…let's say quantity demanded, we take the quantity of good one is equal to 1-p. Now if I say p is the dependent or the independent variable here?

[independent]

Independent. You go to the store, you look at the price, you decide. So our notation is usually like this, okay? When price is zero, the quantity demanded is what? One if the quantity demanded is one, the price is? Zero. Okay. So that's not very hard. And you think that makes all kinds of sense. But remember, in economics we're doing the inverse. We're inverting that and for this example, it's conveniently symmetric. So the math is… this is q=1-p, and p=1-q. Now why do we use this inverse demand? The simple answer is that it's very convenient to keep Q on the x-axis.

And here's my helpful diagram. Here's Q, here's utility. Utility is going to start at zero and it's going to rise. At an increasing or decreasing rate?

[Decreasing]

Decreasing rate. Utility function, marginal utility…guess what? We put Q down here. That's why. That's why we invert demand. Q is on the x-axis.

This is why we use inverse demand on the graphs.

Marginal utility (u-prime) is going to be (in general) increasing or decreasing? Decreasing right? Let's just say it like that. I'm not going to even bother to make the calculus perfect, right? So the point is, we put Q on here so we can stack these up. And surprisingly, or not surprisingly, our marginal utility…this is like a demand curve. Our marginal utility and the demand curve are (with a little bit of transformation because of prices) the same shape, right? That's why we use the inverse demand curve.

Now why does this matter in terms of…why don't we just take it in the beginning? Because I want you to avoid the confusion that can happen in the following circumstances. Let's change this thing. Qi = 2-1/2p. But then, if we draw that, put in p here and q here. When price is zero, quantity is what? Two. And when is quantity zero?

Four, right. So if we invert that, then we have the opposite intercepts, right? This is the demand curve that you'll be seeing in front of you, but this is what's going on, right?

What's going on in your head is, oh, my price is changing, my quantity demanded is changing, and I say, "Graph it." And then a huge percentage of students try and do this and they screw up. Because I tell them, "Do an inverse demand curve", and they draw this. They draw the wrong one. Because they have to flip it over.

If you flip it over, you get p=4-2q. I say, "This is the demand function, graph it." And they (students, you guys, your peers) draw the wrong graph. But this is what should be drawn—the inverse demand. It matters when you're adding up two people. That takes us to q2, which is 3-1/4p. You want to start aggregating this stuff up. It gets more and more hard to put on the graph or add together. That's what I'm trying to point at. There are calculation mistakes that will happen when you're trying to use inverse demand. Is that a little more in the right direction of "this makes sense" or "this is useful"?

It's the conventional presentation in economics that we use this. And this is what we're going to be using, and I want you to understand that there's this little trick called inverting going on, and you will not make mistakes in terms of presenting the material that way. But it's also helpful to kind of think about how these graphs fit together. Any questions off of inverse demand? No.

Then here we go. Deadweight Loss, yay! Okay so what's deadweight loss?

What does that mean? What does it mean?

[Loss of efficiency]

Loss of efficiency, right?

As I said, this is kind of going back over some stuff. We're on the full market right now, so we have aggregate quantity. We have our supply curve and our demand curve, and this is our equilibrium point. P*, Q*. Let's just do some labels here. This is A, B, C, D. What's the social welfare in this diagram?

A? A and B, right.

So let's say that we impose a tax. It's going to drive a wedge between the supply side and the demand side, right? The tax is going to give us a new Qt, this is a tax revenue, and the deadweight loss is where? The triangle, right? Here.

This is a loss in social welfare, in a sense, reduced efficiency. We've lost some goodness from exchange because the tax makes the price the producers pay different from the price that producers receive. Deadweight loss, that's what we call it.

And just to extend deadweight loss to keep the political economy theme intact…is there a deadweight loss to collecting taxes? Who here does their taxes? Does it take you more than zero minutes? Yes, right? That's a deadweight loss. That's your time, right? What you really want is to, (well you don't want to pay your taxes at all) but if it was going to happen at all, just disappear the money. I don't want to deal with it right? You don't

necessarily notice it when you pay sales tax. You go to the store, you buy your stuff, the tax is added, off you go.

Or you go to a meal, and, "Oh my god, I've got to leave a tip." And then you leave it there with six people, and they all want to use their own credit cards and leave different tips. That's deadweight loss. Another kind of deadweight lost that is not in this triangle. That is connected to this tax. Often, it's smaller than the size of the tax, but what it does is it reduces this tax. Because what is this tax considered? What is this tax considered to be? In terms of who wins and who loses? Why is it not a loss, usually, under typical economics?

[It goes to the government.]

It goes to the government. It's a transfer. It's supposed to be a frictionless transfer. But if there's friction, then this nice little net triangle gets smaller and smaller and smaller the greater the friction.

If you send lobbyists to Washington DC to lobby a tax on your behalf, because you're part of the healthcare industry or you're part of the agricultural lobby or whatever, those are more deadweight losses. I'm not sure, but I wouldn't be surprised if some circumstances where the…

Oh so, if I change the price of…when Damien talked about the AC Transit example, the bus is empty. The idea is that if the bus is empty, what should the price of the bus be? Zero. Until congestion shows up, right?

But what if someone says, let's just charge a penny, right? There's this massive reduction in the number of people riding, because it's like, "I don't have a penny."

It's a pain in the butt to have a penny in your pocket, right? So a tax of 1 cent can actually produce more deadweight loss than revenue. That's the idea about deadweight loss connected to taxes. Subsidies…what would a subsidy look like? Anyone? Louder?

Does subsidy increase or decrease consumption?

[Increases]

So it's going to be over here somewhere. Basically, we're just say, "A subsidy makes the price of that the producer receives is higher that what the producer pays."

So all of this box here, now, is coming from the government. Usually it's coming from the taxpayers, because the government is just an accounting device to pass it along. So a subsidy to car manufacturers to sell clunkers at $1000 a car is coming out of all our pockets, and it's going to people to buy cars, right? And it's being divided back among the people who buy cars and the people who sell cars. But that is this entire box here. What's the deadweight loss associated with a subsidy?

Anyone? A letter? Pick a letter. C? No. D, right?

It's because the value at this point, the value of this good, is much less than the cost of production. It is inefficient. It is a deadweight loss. Subsidies and taxes are essentially mirror images of each other. For conventional wisdom, keep in mind the size of those triangles. For political economy, keep in mind how those triangles get made. The process of setting the tax or setting the subsidy. Which is awfully important. It turns out that you can go to Washington DC and spend a dollar and make $200 by bribing a congressman. It's a pretty cool business, you know? Now you know why there's 40,000 lobbyists in Washington D.C. Pretty sad for all of us though.

Any other questions on deadweight loss, just now?

[I don't get the sectioning off of the letters, and also…]

You don't get the idea of the letters?

[Yeah, I don't get why you sectioned it off…]

I just said, which one is the deadweight loss from the subsidy. D is the deadweight loss of the subsidy. It's almost random letter placement.

[And also, I was wondering, in all those examples, what does it have to do with loss of efficiency…I don't think I have…]

Loss of efficiency. So say that this guy can produce this bottle in one hour. And you can do it in two hours. And for some reason, you are the only person I can hire. I've just wasted an hour of everybody's time, having you do it. You're less productive than he is. That's the inefficiency. It's like…a tariff will protect American sugar producers from the Brazilian sugar producers. So Americans (if you don't know this already) we pay like double the world price of sugar producing the sugar that we couldn't be producing. Because, essentially, it's a subsidy to American sugar producers.

[Why would a tax cause deadweight loss?]

A tax would cause deadweight loss in two respects. One, it will restrict the amount of trade going on, so quantity is falling. That's the triangle. And a tax will have a deadweight loss because of the lobbying about who gets to set the tax, on what, and where.

[What would be the price charged for the subsidy for that graph?]

The price charged is going to be this lower number here. The higher number is the price received by the producer. The difference is the amount of the subsidy.

[So would a tax be analogous to a price ceiling?]

In a sense of deadweight losses. Let's do that one.

So this is P*. You can only charge this much. Price over bar. The quantity in the market is here. And the deadweight loss is here.

Or is it? So, a price ceiling…you've got to some how…a price ceiling is worse than a tax, because a tax creates this box here, which is a transfer from the people who are making transactions to the government, which goes to somewhere, right? That's actually just a transfer. But if you have a price ceiling, the consumer is paying this, and the producer…well sorry.

This is the demand here, at that price. The demand is greater than supply, because the price is too low. So somehow, you've got to raise the price so that the demand actually equals the supply at that price ceiling. That price is usually raised through queuing or waiting. This is the New York rent control market. Some people in New York, they've lived in the same place for 15 years. Or they haven't even lived in New York, but they have the same place. So the price is raised in some way that is not a cash way.

Diagramming all the little triangles (I should probably do it, but I'm not going to do it right now). So it's not the same. The losses are worse in a price ceiling. That's the…

[But it still creates that loss]

It still creates that loss plus more.

[So do all taxes create deadweight loss?]

In theory, yes. When they would not create deadweight loss, this is when?

[When there's no transaction costs at all?]

Well, no transaction costs is going to be there. When would a tax not create a deadweight loss?

[An externality?]

Well, that's not exactly right. But it would…let's put that aside and say yes, but that's not what I'm thinking about.

So what about this scenario? I want perfectly elastic demand. Perfectly inelastic demand. So we do supply, we have demand, here's price. Here's price raised by tax.

There's no deadweight loss because the amount consumed is identical.

[So are there economists who would say that taxes… almost nothing has this demand curve.]

Supposedly, this is the case with what, cigarettes, right? Let's just tax the smokers. At $7 a pack. You know in Europe it's expensive to smoke.

[But then it's basically saying that taxes are always inefficient except for some very rare cases where somebody is addicted to something]

Taxes always produce losses. Whether they're efficient is a different question.

[Okay so deadweight loss and efficiency are not necessarily connected? I mean I thought that something is always inefficient if there is a deadweight loss. Right? No?]

Well the deadweight loss is about social welfare. Surplus. Right?

Efficiency, whether or not it's efficient or not, is, like in the case of a pollution tax, is different. It's meant to offset.

If you have a tax on cigarettes, a subsidy would be different because production goes beyond where it should be. A tax is…reduces social welfare. Is that the same thing as efficient?

Not necessarily producing an inefficiency. So it doesn't match one to one. It's not identical. So if you need to know what's going on with subsidies, there's always a welfare impact, and there may be an efficiency impact. How's that as a clarification (or at least is seems to be a clarification).

Any other questions about this? I should do a whole lecture on deadweight loss.

[So based on my understanding, the more elastic it is, the higher the deadweight loss, right]

Yes. The more elastic…so we've got this (here's our tax) compared to over. So it will grow in size the more elastic things are. Because the more elastic, the larger the response. That's elasticity.

So yeah, but the number of goods in the world that are perfectly inelastic is very small.

[Can you give an example of what deadweight loss looks like for subsidies?]

That's what I just did with the triangle over here.

[I know, but I'm still kind of unclear why there's deadweight loss with subsidies]

Because the American sugar producer is producing sugar, but they should not be producing sugar. They should be doing something else. Producing alligators or something like that. In Florida, they do it Florida.

Actually a lot of…some of the Katrina damage was exacerbated by the sugar production in Lousiana. They changed the bijou of the fields (in the agricultural areas), and the bijou didn't absorb the storm waves. So bang, you get a bigger impact. So that's like a crazy example of an inefficiency or a social welfare loss.

Good topic.

So say that I get utility is a function of beer and chips. And I'm going to put chips on this axis and beer on this axis. Both of them are normal goods. If I have more beer am I happier or sadder?

[Happier]

Happier, right? Forget satiation for a second. If have more chips, am I happier or sadder?

[Happier]

Okay now, here's the question though. There's a tradeoff between these two. So I'm going to show you. If I say that beer and chips are perfect substitutes, what does that mean?

[That each unit will give you the same amount of happiness?]

In a sense, not exactly. If I take away one unit of beer, then I have to add or subtract chips? Add. So we know about beer and chips, right?

So if I'm here, and I take away some beer, then I have to add some chips in order to remain indifferent. Now if I take away another beer, do I add more, less, or the same amount of chips?

Same amount. They are perfect substitutes. And what does that mean, by the same amount? That means that the tradeoff between beer and chips is constant, right? The slope of that line is the same, all the away along there.

Now I'm going to call this utility one, because my utility on this indifference curve is the same everywhere on that indifference curve. You are indifferent. That's the meaning. Indifference curve? You're indifferent. You don't care.

I could be here, I could be here, I don't care, I'm just as happy.

[If you have to give me 2 bags of chips for every one bottle beer, which would change the slope, but still leave…is it still a perfect substitute?]

As long as the slope is the same slope, it's okay. Two for one, two for one. That's fine. Fourteen to one, fourteen to one, that's fine.

Now, am I happier or sadder? Where am I happier? A or B? B.

I'm happier, because more is better. This is my utility is increasing. So utility anywhere on indifference curve 2, my utility, is the same, less, or more on indifference curve (or utility curve) one? More. You have more utility on two, because you have more on both. Right? Here's how much beer and chips I have and it's like, wow, look, more chips, right? Or more beer. I'm happier. Those are perfect substitutes. But in general, indifference curves…

In general, if you're drawing a tradeoff between two goods…

In general you're utility is going up as you have more. This is the assumption that…the basic assumption of economics. Remember I talked about satiation the other day?

If you're utility is going up, and you're utility is going down, essentially as you go out here that's like, "I've had too much beer, I threw up." Right? That's satiation. But what we're going to assume almost all the time is that you're not satiated.

So what happens if I need to have…for every beer I have, I have to have a bag of chips. What happens if you give me two bags of chips?

So I'm here, and I go here, am I happier or sadder or indifferent, if I need (always) to have one beer for every bag of chips.

Not sadder, you just gave me more. What do I do with the bag of chips? I throw it away; I don't actually care. More chips does not help me. You can give me as many chips as you want; I haven't gotten any more beer. I am not happy.

And similarly, if you give me more beer, I still only have one bag of chips. I don't care how much beer you give me. You give me more chips, if you give me more beer.

This is actually an indifference curve. Who's the Russian it's named after? Wassily Leontief. He was actually an agricultural economist, and what he talked about is the idea that you need to have things in a fixed ratio, right? These things are called perfect complements. Is my utility higher in U1 or U3? Where's my utility higher? U3. More is better.

But I need to maintain the ratio between these goods. The way we write this utility function is: utility is the minimum of beer and chips. If we have a one to one ratio (which I basically told you we do) that means if I have…

Let's look at these numbers here. I've got 2:2, 2:3, 3:2. Utility is the same for all of these combinations. 2 beers 2 chips, 2 beers 3 chips, 3 beers 2 chips. They're the same utility because I'm going along the same indifference curve. I need to keep that ratio 1:1.

You give me more beer, you've got to give me more chips. They're complements. They go together. Does that make sense? Does it make sense? What part of it doesn't make sense?

[So for each of the two graphs, they're both indifference curves?]

I'm drawing lots of different indifference curves. These ones are indifference curves for perfect complements.

[So you're saying for that this ratio, it's not correct…that they're not going to be happy for anywhere along that curve?]

They're not going to be *more* happy. They're going to be just as happy.

So if I'm here, and you give me more chips, I'm not happier; I'm just as happy as I was. I'm indifferent. You give me more chips…whatever…I don't care. Might as well throw them away. If you give me more beer, then I'm happy. We have more beer and more chips, right?

[Why is the utility the same for all of those]

This is the ratio that you have to maintain. So this utility here is 1:1. This utility here is extra. It doesn't help me. I don't need that three. Three, or forty-two. I don't care how

many bags of chips you give me. Unless you give me more beer, I won't be happier. I need like…right hand, left hand.

Here's a really easy example. Left shoes and right shoes. Sorry, I should've just done the easiest one. Left shoes and right shoes. How many left shoes in your closet do you have without right shoes attached to them? It's like, "Oh, I lost a shoe. Well I really love having one shoe." That's what you need. You need to have pairs of the shoes. That's a 1:1 ratio. Beer and chips is a…I'm using beer and chips because it's stylized in order to fit all the different indifference curves. Substitutes, complements.

[But I think that we think that the more is always better holds true, then that doesn't quite make sense because theoretically then trade my bag of chips…it's like 5 bags of chips for another beer and I can't keep one of them or else…]

Ah, you're trading, now you're in a market, we don't do that yet. But you're right. So I'm going to say it this way. Utility of (2,3) is greater than or equal to. But in the case of perfect complements, it's only equal to. In the case of substitutes, it's greater than. So in a sense, utility and more is like…you're not worse off…you might be better off. But you're not better off if you have perfect complements. This is actually the utility more versus less. You're either going to be better off or the same. And if you're perfect complements, they're always the same. Does that make a little more sense?

[I mean, I believe it in theory, but I don't quite believe it in practice though.]

Left shoes and right shoes. How many left shoes do you have without rights?

[Actually, I have one, because I still keep it]

You're still waiting for that right shoe to come back.

[Well I would still just keep it out. And I think most people, for example in a restaurant, if you offer them hot dogs and beer, and they only like to drink one beer with one hot dog, and you offer, for the same price, two hot dogs and one beer, most people would still go for it even though they don't have a use for it, because you just think…maybe for later on, or maybe there'll be...]

But the perfect complements is an extreme example. Perfect substitutes is another extreme example. Most people say, "You know what, I don't want more chips. I want some beer now."

So let's bring that up, because that's a good point. Let's go to the way that most of the world works. The indifference curves are somewhere in between. So we've got…so somewhere in between this world and this world…perfect substitutes and perfect complements…what's in between? What are they going to look like? What's the mathematical name for this shape?

They're convex. That's my indifference curve between beer and chips. In fact, most peoples'. Most people are like…yeah…more beer, more chips, I'm a little happy about that. You can't give me more beer right now, I just need some more chips. They're not

perfect substitutes, they're not necessarily perfect complements, they're basically just in between. I don't even know what the word for it is. Does anybody know the word for in between? They're whatever. This is like 99% of the world. This is left shoes and right shoes. In my world, this is like Coke and Pepsi. It's like, "I want coke." "Well, we only have Pepsi." "Okay, I'll have a Pepsi."

Or one dollar bill versus another dollar bill. It's still a dollar. Those are perfect substitutes. So what does this mean here? Is more better in this world? Yes, it's still better. And now there's a tradeoff between…there is a tradeoff between these goods… but the tradeoff is not always the same. Here's the thing. Say that you've got a whole bunch of beer, but not very many chips. If I say I'm going to give you another bag of chips, are you willing to give up a lot of beer, or a little beer? A lot of beer, right?

Let's just say that this is one, and this is four. Whatever, right? Because you've got so much beer…you're like, "I've got plenty of beer." I've got four kegs and a bag of chips. It's like give me one bag of chips, and I'll give you a keg.

You're willing to give up a whole bunch of beer to get one more bag of chips. You are indifferent at that new point. So that's the tradeoff, and as you go along here (and now you're over here in chip land) and I say, I'll give you another beer. Am I going to give you a lot or a little bit of chips? A lot right? You're going to do the same thing.

Basically what that means is that if you have a whole bunch of something and not very much of another thing, the ratio of exchange changes depending on how much you have. In order to maintain your point on the difference curve. Obviously if I go from here to here, I'm happier. Even though I have the same amount of chips, you just gave me beer. I'm as happy. I'm on a higher utility curve. Higher indifference curve.

That's what indifference curves are, and now why do indifference curves matter? The handout I gave you is called constrained optimization. And what's the constraint if you have constrained optimization? Income. Money, right? There was no income on these indifference curves between beer and chips.

So when we just draw an indifference curve, there's no money. And at this point here, there's a marginal rate of substitution. There's a substitution between one good and the other. It's called marginal because it's a curve, and we use calculus, and on the margin, and it's a small change in one thing and a small change in the other thing. So the change in beer over the change in chips. Depending on where we are in this thing, is going to be the Marginal Rate of Substitution. Depending on where we are. And you can…

A certain slope at this point is the calculus part. Adjusting for where you are is what makes that Marginal Rate of Subtitution part the same. Help me out here, is it the same?

The elasticity's the same along this curve, but this is the elasticity part. This is the Marginal Rate of Substitution part. Right? Maybe?

[I think this is MRT]

[No I mean, this is not an elasticity. Because this is just preference. No prices, so this is not elasticity, but this is specially…these is for the marginal rate…]

The slope is changing, so the amount that you'll substitute for the other is changing. That's what we mean by marginal rate of substitution. And as you go from here to here, they're not the same.

Now if we wanted to find out how much we would consume, if more is better, then we'd just want more and more and more. Constrained optimization, to get back to what I was trying to say, is how much money do we have, right?

So let's just say that the price of beer equals two, and the price of chips equals three, and say that our budget is equal to six.

If I spend all my money on beer, how much beer can I buy?

Three.

If I spend all my money on chips, how much can I buy?

Two.

This is my budget constraint. There's an economic tradeoff between those two goods. Where I will consume (this line is meant to be exactly tangent, or exactly just touching) is right here on this point A. I will consume A units, or the bundle A, which is based on the price of beer and my price of chips and my budget. If you give me more money, am I going to consume less or more of these two goods? More, right?

If I give you more money, is that budget line going to shift out or in?

[Out.]

Is it going to be parallel, or change the slope?

Parallel. The slope isn't changing, the price hasn't changed. We just change this. We'll call this twelve, right? So now we're out here.

So we're going to go to…from this point to that point. It doesn't necessarily matter what the bundle of goods is at that point. You're just going to consume more, okay? And you're going to be on the highest possible indifference curve. So say that I have (This is an indifference curve here). U1, U2, U3. And say that this is my budget right now. Am I going to be on the indifference curve one or indifference curve two?

[Two]

Two, because this is tangent right here. That's as much of the good as I can afford. If I am on indifference curve one, I've got all this area here that I'm not getting. I can consume here, or here, or I can spend all of my money, but I can actually be on a higher indifference curve by changing the ratio of the goods.

I can go from here, I'll consume a little bit less chips and a little bit more beer, and I'll be happier. So you're always going to be tangent to that budget constraint. So when you say constrained optimization, that means we're going to be optimizing as much as we can, subject to the constraint. And the constraint is the price and budget. The optimization is how much…what's the bundle we're going to consume. It's optimal consume so we're right here. So we're tangent.

[So under U1, you have room to choose between the two?]

You have room to choose, but you just bypass that whole thing and go to U2.

[But the…could you want U1…]

You could want U1 if you don't want to maximize what you consume. But we assume that you want to maximize that. So that's that satiation problem.

If you're this, you're essentially indifferent between these two points with U1. But right here, you prefer C to A or B for sure because it's an indifference curve. And you go higher as you go out. You get more utility.

[But then in theory, could you be…one day you really want beer, you could use U1 and say…look at how much beer I have under my budget]

Well, that would mean that the shape of your indifference curves are changing. So instead of having this kind of indifference curve, you're having this kind of indifference curve. You're changing your indifference curves.

The important thing is that, this is today, and that's tomorrow. Right? The important this is that we assume that your indifference curves are the same shape on a given day. This is a consistent set of preferences. It's inconsistent to have indifference curves that cross. Because we don't know what the hell is going on. And that's a big point because that's the math of economics.

[This is always assuming that the individual wants to maximize right?]

Right. So it's constrained optimization, so if it's unconstrained optimization, it's like, "I've got too much money. I don't care; I'm done."

Then there's no math to do. They just chose something. That's the whole idea. People do hit a satiation point at some point. That's why we assume nonsatiation, so we can find that optimal point.

And that's what you will be doing on the homework. Assuming that you're not satiated. Other questions?

Okay, I'm going to keep pounding on this preferences thing for a little while.

Just as a…when we draw this set of preferences here, and we're trying to describe the utility function that underlies these preferences, we say that the utility is equal to the minimum of beer or chips. We have to have those in some kind of fixed ratio. Here, we

say that utility is equal to beer plus chips. It could be in some ratio. It could be 2 beer plus 1 chip. But this is the same idea. This is how we write down that utility function. We have that kind of constant trade off.

In the middle we have…we need a little bit of each. We need utility (which I'm just going to say beer to the alpha) chips to the one minus alpha.

And alpha, if you assume alpha's positive, which we do, and it's less that one because utility goes like this, right. If it's like this, it's alpha is greater than one, but we don't have this kind of utility function. The more we have, the happier I am. We don't do that. That's not how it works. That's Alpha is greater than one. This is alpha less than one.

So if we say it's beer to the alpha, chips to the 1 minus alpha, the sum of these exponents is one. That's a particular kind of utility function. Or particular mathematical function called a Cobb Douglas (not a Cobb salad) with 1 "s". This Cobb Douglas thing is going to hit you over and over and over again for the next twenty two million classes

The generic form of a Cobb Douglas is something over here (could be a production function, could be a utility function) and it's going to be x to the alpha, y to the one minus alpha. It's just used all the time. It's mathematically convenient.

And we'll get to production technology. It's a strong assumption for production, it's not such a strong assumption for utility functions. And basically, look at this for a second. Think about this for a second. What's…

If you have that shape of the utility function, you don't even know what alpha is. But if beer is equal to zero, what's your utility? Zero, right? Zero times anything is zero. That's an important point. Chips are equal to zero, utility is zero, right?

So you need to have some of each. But that's why these things go asymptotic. They never touch the axes, right? These indifference curves. This will go out to one beer and 600 million bags of chips. But you never go down to zero beers. Zero beers is right here. Zero utility.

So this form is going to be used all the time. It essentially means that your utility depends on the amount of beer and the amount of chips that you have. You can't have zero, one.

[What does alpha supposed to mean again?]

Alpha is just an exponent between zero and one. We use that notation that we just had. It's not equal to zero, and it's not equal to one. It's somewhere in between. I'm not saying this. That's not it.

Now, just as a quick hint, my utility is equal to b alpha, c one minus alpha, and I want to do a Lagrangian. And it's going to be b alpha, c one minus alpha, minus that. Price of beer, beer plus price of chips, chips. Minus m. right?

That's the basic setup for the Lagrangian using this utility function, right.

Now if you take a derivative with respect to B, you're going to have alpha B, alpha minus one, times C one minus alpha equals lambda, P, B. That is a mess. Okay now you know it's a mess.

So in mathematics and economics we assume that you can use what's called a monatomic transformation. I'm just saying monatomic transformation basically because what it does is it doesn't change the order of things, right? Two is always greater than one. Three is always greater than two. So monatomic means things are all moving in the same direction.

And you can rewrite this, without failing the class, as alpha natural log beta plus one minus alpha natural log chips.

Now when you take a derivative of this (I'm writing this because it's on your homework, and you guys are going to cover this in section). You can take a derivative of this and can call it alpha over beta. That's a much simpler…alpha over beta.

Plus, this is with respect to beer. Alpha over beer. This versus this. This is much simpler to work with.

I can't do math. So this is much simpler to work with. And this is the hint. You see one of these things, transform it into this, then start taking derivatives, and you'll get chunks like this. It'll be minus lambda, price of beer.

This is much simpler to deal with than this up here.

[I think you missed one, minus one, because if you take log, you get…oh no, no, it's fine.]

[How do you get that transformation?]

It's just something you can do. You just say, take the natural log of this function and it'll turn out this way. So it's like…take a class in calculus and that's what happens, right?

So this is the math background you're supposed to have in a prereq.

[The natural log of the previous two? Or which one]

If I take the natural log of this thing here. Just this utility function. So this utility function will become this utility function. Then I can add my other part of the Lagrangian.

[So what's that second term?]

This is the derivative of this. Let's just do it this way. 1, 2, 3, 4. So the derivative of one prime, gets you to two, and that's a mess.

The derivative of three gets you four, and that's cool.

[And then the natural log of one gets you three?]

That's right. Yeah, perfect. So we want to use three, we don't want to use one.

[Going back to one to two, basically you're took it in respect to b? With beta?]

This is Lagrangian with respect to b, beer.

[Why don't you take the natural log of the rest of the terms?]

This has been transformed into this, but not this part here.

[Yeah, why did you…]

Because I'm just talking about the utility function before I put it into the Lagrangian structure. So you transform it first, then you can put it with this part here. This does not change, this is okay. Other question?

[I know that you said you assumed that the lambda would be positive…]

There's a positive coefficient in front of the lambda, yeah. So you could say plus or minus lambda when you set it up. Doesn't matter, just be consistent. I'm using a negative just because.

[So four would be the derivative in respects to beer?]

Four is the derivative with respect to this equation three.

[Of the whole thing?]

Yeah, because I'm taking it with respect to b. So this is doesn't even happen, right? It drops away. It'll be fine. You'll have a great time with this homework.

Any questions on this right now? I'm going to flip through my notes and make sure I haven't missed anything.

[What is Edgeworth boy…]

Edgeworth, oh yeah, let's do an Edgeworth box. Okay I'm going to do two things quickly.

We have five minutes, so hold on.

[How is that the same function if you take the natural log of it?]

It's a transformation of a function. So basically…

[Inaudible]

So your utility of beer plus chips.

And you say, "two times that". Your utility is still growing, but your utility is not the same number. It's still growing.

So this is a transformation. This is a monatomic transformation of this. So the idea is that you're not changing the way you think of beer and chips. You're just doubling everything, right?

So it's like the money illusion. If you double the amount of money in the economy, prices will double, income will double, you're the same. You're just as happy. That's the kind of monatomic transformation.

So let's look at the Edgeworth box for a second. It's a concept that may come in handy when…it's a way of understanding prices and bartering. And there is no money. So over here on the bottom, I'm going to call this chips, and I'm going to call this beer. Now we know that if I'm over here, and I have indifference curves like this, I can just keep going, going and going.

But this is my origin over here, O1. But say that someone has this, O2. And for me, this is more beer. And this is more chips.

At O2, this is (0,0). Flip it over upside down. Flip it over, it's upside down. This is (0,0). This is more beer. Zero beer, more beer, does that make sense?

What are these persons' indifference curves going to look like? They're going to look like this. I'm just flipping it over I'm combining essentially two sets of indifference curves in one box. Everybody seeing that? Now here's the key.

Let's call this U Mr. A and U Mr.B. There's a tradeoff.

Whenever you see two curves touch in economics, pay attention. To curves crossing, two curves touching, that's when you should pay attention.

This here is a place where these two have the same substitution between two goods. They have the same Marginal Rate of Substitution between two goods. In a sense, if they wanted to have an exchange, they'd be able to set a price between each other. An exchange price that actually runs right down the middle here.

Now before the time I drew a straight line I said this was the budget constraint, because that was the tradeoff between one good and the other based on your budget.

This line here just represents a price exchange between these two goods. Forget the budget constraints, because there's no money here.

The idea is that if two people want to trade, they'll trade at this point here.

If we draw an Edgeworth box here, we say…there's one person there's the other person. Then they're not trading. They have a lot of space. There's all this area here that's open for moving together. Open for exchange. And they'll move towards each other until they stop here.

And the reason that they'll move towards each other is because the sum total of chips in this world is represented by the length of this line. I'm bringing up a really big concept, and I'm just mentioning it. But this is like a Robinson Crusoe world where you have no

money, you just have beer and chips. And someone's got beer and someone's got chips, and they're trading off with each other.

They're trying to go away from their origin.

[So everyone's trying to get to the best point, which is the middle]

Okay, let's call it quits. I'll see you guys on Thursday.

Transcribed and checked for accuracy by Brynna Bunnag