EEP100: Lecture 5 (Sep 10, 2009)

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Any open questions? Questions and answers?

[I realize that the AC Transit does really just help people that could just walk to campus. It's like…well the bus is here, I'll go for it.]

Right, so that's why we get fatter and fatter right? We don't even walk to campus.

Any other questions?

[I had a question about endogenous versus exogenous loss? I guess you were saying… you know…the fishing example. We all got together and made a rule, and that's endogenous. I'm not clear on what exogenous is]

An exogenous situation might be where some outsider comes and makes a rule for you. Yeah, that would be an obvious one. That's basically it. If endogenous means the people that are acting are making decisions that are affecting what's going on. So for example, you go to a store, and you want to buy a quart of milk, and it's $1.45 or whatever the price is. That's an exogenous price. And then you go to the store in Egypt and you say I want to buy some dates. And he's like, "It's $2 a kilo." And you're like "How bout a dollar fifty."

The price is now endogenous. You're bargaining. Okay? So that's kind of one way to keep it straight. I'll throw out the word quite often, but it's useful to keep track of that.

Okay, is the tape rolling okay? Great.

Swine Flu: if you get swine flu, don't come to class. I already had it this summer, so it was very exciting. I recommend that you don't get it, but if you do get it, you're supposed to not come to class. I'm supposed to give you all kinds of excuses; you don't need paperwork, so keep that in mind. It's very likely that everybody's probably going to get it by the wintertime, so look forward to a very high fever. But you should notify me, especially if it's related to a deadline. If you don't come to class, then hopefully at some point we'll get our act together and get all the video and audio up there so you can catch up if you feel like it.

So somebody asked me about the blog entry, and it's due on October 1. For the sake of expectations and so you guys know what I'm looking for, so you can start thinking towards it, I want to outline a little bit about the blog entry. Who has actually written a blog entry ever? Okay, about a third or 40, 50 percent. So, you might have a clue about what's going on.

Those of you who haven't written a blog entry, it's basically your opinion about something, and what I want you to do is take any issue and analyze it. You don't have to solve hunger. Start with something small: the AC Transit thing is an example, but that can also grow very large very quickly. So you want to say: "why is it that some cars have lots of bumper stickers on the back of them and some don't?" or anything like that.

Whatever is interesting to you. So it's your opinion, but I want it to be backed up with analysis, and it's going to be economic analysis. And as I mentioned before, I'm not going to grade your blog entry. So when I said it's intrinsic motivation, you want to do a good job because this is you being an economist.

And somebody said: "How long is it?" And well I think it's somewhere between 100 and 500 words. Or as they say, as long as it takes.

So I have a post this morning, a big opinion about the aspect of fear in our culture, and I counted…the word count was 600 words. It took me about a half an hour to write that yesterday. Also, it should be your first or second draft. Don't sit there and get all excited about having perfection.

600 words is really long. 100 words can be fine. You can write a Haiku, I said to someone, go ahead and do a Haiku. You can do a video version if you feel like it. What I want you to do on October 1, and this is all time-stamped, I want you to e-mail it to me. I want you to e-mail it to me Plain Text on an e-mail.

Not Microsoft Word, which is like a disaster in terms of html. So just send me the text and say, "blah, blah, blah"…and if you have a link to a website, put that in square brackets, so I can insert the links for your stuff. And if you have a picture or an image or something like that, you can either send me an html or a link (just an http link) because the image is on the Internet somewhere, or you can send me the image as an attachment. Alright?

So October 1, midnight, alright? It's Pacific Coast Time, alright? So don't do Hawaiian time. And it'll be time-stamped. So if it's in my inbox, you get credit. If it's not, you don't. Alright?

And then I'm going to post those in a reasonably random order, as long as it takes to get them all out. If there's 90 students, and I put out 2 or 3 a day, if it takes me 30 to 45 days to get them all out on the internet. And I'm putting them on the Internet in order for you and your parents to check my blog everyday to find out if the post went up.

I mean 00:01 = 0 points. You can send it to me today if you want to. There's no reason for delay. You don't have to wait for the event of September 30th to write a blog post. But I want you to get it in. Does that make sense? Okay? So October 1. Not the second.

[So the topic? Does it have to be related to environmental….]

It has to be related to environmental resources in some way. I am talking about political economy a lot, so if you want to bring in political economy…if you start going of into the drug war, it's a little bit more vague…if you talk about "why I like shoes"…I don't want that. So try to keep it somehow tenuously connected to the material on this class.

The easiest thing to do is to write about something you know. If you're a baseball player, write about baseball. If you like knitting, do that. If you hate cats, do "I hate cats."

Just do something that you know. Don't sit there and go read the encyclopedia and try to figure something out. And don't cut and paste a Wikipedia or something ridiculous because it'll just be boring. Any other questions on that? Not just yet? That's just a little reminder.

Now let's go back over statics and dynamics a second because I just wanted to reemphasize where we left off last session.

So the statics vs. dynamics, as I mentioned, you just go from statics (and let's just do it this way—this is easy and hard). And I mean hard to explain, to diagnose, to analyze. Because when you –we'll do some more game theory later on—

Just consider a chess game. A chess game is pretty much a very good example of a dynamic. So that's why game theory is named game theory. It's how people play games. And you're playing an opponent, and the opponent knows what you're doing, and you know what they're doing. So you're going back and forth trying to outsmart each other. So dynamics is very hard to diagram. It's very hard to do mathematics of dynamics. I do experimental economics. Experimental economics, which I'll be doing later this afternoon, the experiment is an auction. How do you determine what people are doing in an auction? And the mathematics of it—to try to figure out what your strategy is, and what your opponent's strategy is, and how you respond to that…but then there's seven other opponents…that just blows up out of control immediately. Imagine an 8-way chess game. It's just going to be impossible.

So the math falls apart, and what that means is that it's hard to really get a concrete idea of what's going on. But that doesn't mean you don't have a feel for what's going on. What I said before about the difference between theory and reality—we know that things are going to move in a general direction. When you have a game of chess, you know that your opponent is trying to beat you. You know that's true. How they're going to beat you is the hard part. That's the complicated part. And most chess players don't try to predict the game in advance. They're just trying to stay in touch with as many moves as they can, so they can beat their opponent.

When you get to statics, it's much simpler. It's like a playground swing. I get on the swing, and I swing. You don't have to deal with the swing…the swing is an exogenous thing. The swing is just sitting there—you get on it, you swing. It's very simple to understand.

In fact, a lot of economists have made the mistake of trying to use physics and explain economics. And physics—that can be quite easy. Those particles in physics—they don't think. They don't get upset if you touch them the wrong way. But humans are much more interactive. And the worst thing is, and this is back to the endogenous thing, when you change the law, and you expect people to not change their behavior, you've just made a huge mistake. Not just because of the law—say you raised the price of something…

Here's a good example of statics vs. dynamics. So let's say that the demand for gas is equal to a billion gallons, and the tax is 10 cents a gallon. So you're going to get 100

million dollars of taxes. And they you double the tax to 20 cents a gallon. Are you going to get 200 million dollars in tax revenue? No.

First of all, you know you're not going to do it because of the pure law of demand. You can expect that to happen. And unfortunately, a lot of politicians don't even get that far. But then you might have this situation: this might be so small that no one pays attention.

But then there's headlines in the newspapers, and they're like, "Oh, gas, why am I using gas?" so they really change their behavior in a dramatic way. If you treat the gasoline tax like a static environment instead of a dynamic environment, you're going to make a mistake. That's why you want to keep it in mind. You have to keep it in mind that people are going to respond to it in different ways, and that this very simple prescription that you're going to give of going from 100 to 200 million is going to be wrong.

[Is there one in which the rules don't change? I think I'm a little confused about rules. About how the standards play out. Is there one between them that the rules don't change?]

I'm not getting it. Do you have an example? Or should I come back to that? Hit me when you get what I'm supposed to respond. I don't quite know how to respond to that.

There's a continuum between these two. You have very static environments—we're all dead. And you have dynamic environments—we're all running around playing soccer.

And in between (sports is actually not a bad idea) you have football…American football…where everybody sets up on the scrimmage line, and they do the same thing over and over again.

Whereas, international football everyone's running around and no one knows what's going on. Or they think they do. There is a continuum between the extremes of dynamics and the extremes of statics.

To keep back with the easy and hard thing…you've got partial equilibrium versus. (I'm going to put the double headed arrow here to show that that's continuous difference) general equilibrium. And partial equilibrium might be where you have just a little demand curve. And we get back to our favorite pork—you have the price and you have the quantity, and you say "What happens when I…"

If I do this you're going to have less price, less quantity. That's just a basic partial equilibrium analysis. I'm looking at that and saying that's going to happen. But then you look at general equilibrium and you say, "Well wait, if that price is going to go up, then how is that going to affect the supply and demand for chicken?"

And so if the price for pork goes up, then the demand of chicken should go what? Up. Because they're considered substitutes. They're considered… the best example might be Coca-Cola and Pepsi. Like…what is the difference? So if the price for Coke goes up, then the demand for Pepsi will go up, right? Because the people will be shifting from one to the other. What's that called? What's the jargon for that kind of elasticity?

[Cross-price elasticity?]

Cross-price elasticity, exactly. Cross-price between products that are substitutes for each other. Or even complements for each other.

So, this is partial equilibrium. As you start adding those impacts to the other goods in the market…pork might be related to barbecue sauce. Because barbecue sauce is a substitute or complement for pork? Complement right? Because pork and barbecue sauce go together.

And chicken is a substitute. As you start taking all of these things into account, eventually you end up going to sales of barbecues, or employment of teenagers at Lowes or at Home Depot, and then the demand for hot rod cars because of teenagers wages, and then it goes "boom"—it blows out of control. Out of comprehension. But it's all happening, because out there in the world, we have all these dynamics going on all the time.

So you have to keep in mind, besides the fact that equilibrium doesn't really happen, that all these things are moving around, and you use this partial equilibrium analysis just as a form of simplification to talk about some basic ideas—some basic economics. Statics and dynamics.

And the third example of easy vs. hard is going to be: in the marketplace, if we have a perfectly competitive market, what does that mean in terms of the consumers and producers in the market? Is the price of the market endogenous or exogenous? Perfectly competitive. I'm linking all this jargon together in one sentence now.

Perfectly competitive market: what do we assume when we go into the market place as a participant.

[That a trade will only take place if you're both happy?]

Not exactly, that's always true. Do you affect prices in a perfectly competitive market? When you go down and…"I'm buying an iPhone, and my demand is significant, so give me a deal." Does AT&T or Apple care about me? No.

So what is that called when you don't affect prices? Price-taker ,right? What's the opposite of price taker? Price-maker, right? You're affecting prices, or whatever. So this is exogenous, and this is endogenous. You're a price maker…who's a price-maker, what's the example of the price-maker? A monopoly, right?

Now let's be more complicated. How do you get much more complicated than a monopoly? Perfectly competitive in economics essentially means almost an infinite number of firms that are all entering the market and competing, and it's actually quite hard to find a really good example of that, but it's kind of like a wheat-farmer. That's the idea, you can't really affect the market.

But a monopoly is the opposite. A monopoly might be Cargill. Cargill controls… actually…is Cargill a monopoly in terms of buying agricultural output? Has anybody heard of Cargill?

So ADM is a competitor for Cargill. So Cargill is not a monopoly, right? The way that GM and Ford are not monopolies. They are what? An oligopoly, right? In fact most of the world is oligopoly, right?

The perfect competition, price-taker scenario is again a simplification. The monopoly scenario is another simplification. We're going to get into this later on, but in middle is basically everything.

You have this range from over here to over here, and this might be a monopoly, and there might be very few examples of a monopoly. And there might be very, very few examples of perfect competition. All of the world is about oligopoly. And maybe when you walk into a supermarket you might say, "Wow, my demand for tomatoes is not going to affect the price of tomatoes."

So you might be, as a consumer, a price taker, but then you might go to the farmer's market and do what (with the farmer who's selling the tomatoes)? Bargain, right? So you're going to change the price. You actually have market power.

You're not necessarily…what's it called when you're the only purchaser? Not the only seller? Monopsonists, right? So if you're not the monopsonist in the tomato market, but you might be the monopsonist in the market to buy the car from your little brother. It's like "I don't have enough money, I'll give you $500".

And you're little brother's like, "Ahhh" but that can happen, except that your brother has friends. So then you're going to be in an oligopoly, and then you're going to be competing with other people. And then you get this imperfect competition called, what I said last time, Craigslist, right?

You're trying to figure out who to buy and sell from, and the transaction costs in a non perfectly competitive market are greater than zero. So that's where the oligopoly comes in here. Everybody has some power, and the friction between them is the transaction cost. That's advertising, that's persuasion, that's bargaining…all kinds of things. Okay, that's a little bit more about statics and dynamics. Any questions about that? We'll get back to that endlessly during this semester.

[In this example, we have the perfect competition as static, and the monopoly as…]

Not exactly as static or dynamic. I'm just saying easy versus hard. Price taking is easier to understand. And static is easy to understand. But price taking isn't necessarily static.

[So it doesn't necessarily fall under the static vs. dynamic?]

No, no. I'm just saying that these are just examples of the easy versus hard. That's the continuum I'm trying to draw. That's a good question. Yes?

[Aren't there a lot of monopolies on a local scale?]

Yes.

[Like a lot of towns have only one Cable Company or one electric company]

Yes. So that comes under the category of…it's defined under a natural monopoly for cable, or for water, or for electricity. A natural monopoly, essentially meaning that the cost of setting up a competitor is so high because you have to lay in a bunch of other cables.

And those tend to be regulated. So you have regulated cable companies, regulated water companies, regulated electricity companies. And in a sense, the government provides the roads. You don't have two sets of roads running next to each other where you can switch back and forth, except where? Anybody from southern California? Toll roads, right? Those are often set up as a competition against the public road, in a strange way.

Because ironically the government gives the right for the toll road. Do they want to have a lot of revenue or a little revenue? Lot of revenue. So they want to keep the price of the toll road high, and that moves a lot more people into the free road, but that means that there's no revenue.

So they go back and forth trying to set these prices. And often they set those prices dynamically, right? Rush hour pricing, congestion pricing. If there's a congestion, they're going to raise the price because more people will want to get on the road.

If there's no congestion, then they lower the price because they want people to stay on the road. So that's how these prices will fluctuate up and down. So these things are going on all around us. Other questions on this stuff? We'll be back to statics and dynamics.

Okay, so let's do math. I'm going to start off going through a little math example, and then I'm going to go through more stuff that I didn't get to last time, then I'm going to go to a big math example because next week in section, we're doing constrained optimization and stuff. Lots of math in discussion. And there's going to be homework and the homework is going to have math, so that's why you guys have to start putting on your math caps.

So why do we use math in economics? We use it often because it's short handed. It helps us understand things. It just makes it clearer. So when we say that utility from the good x is equal to the natural log of x…you're like, "Oh, natural log, what the hell is a natural log? Right? I don't even know what an unnatural log is." But why do we use this? What's this shape look like? Anybody help me out on that?

The general shape? It goes like this, right? This is one. But basically it's basically increasing at a decreasing rate. And what is that? What is increasing at a decreasing rate? Decreasing marginal what? Utility, right? Decreasing marginal utility.

So this is actually U of X. What is U prime of X look like? If I draw it right underneath here, it's going to be like this. This is marginal utility. My marginal utility is falling as I consume more and more of X. My first ice-cream cone, my second ice-cream cone, my

third ice-cream cone. This concept will come up endlessly in economics and in life. And it's really useful to take into account.

This is all positive. I just drew another axis here. So this is all completely wrong, well no…this is falling because it's coming down right? This is actually…goes to negative infinity or whatever.

The reason that we're using this math here is just another way of describing utility. We're just trying to use the same concept. Is this any different from that, economically? It isn't right? It's the exact same thing. Root X, right?

I'll do root X. Whoa, looks pretty similar! Two times root X: it's the same thing. Fourteen times root X. It's the same thing. We're just trying to describe this economic phenomenon. Clearly the math is different, right? But don't get attached to the math, get attached to the economics. Is this a utility function? Or is this a good utility function?

[Depends on whatever you're consuming]

You like it more and more and more? I can't even think of something like that. Almost every body satiates…in fact this is actually…let me get to satiation. There's a lot of assumptions that we put into economics, and some of them are pretty stupid. So one of them is called non-satiation. What does that mean?

You never get full, of ice cream right? But after a while you will throw up if you eat too much ice cream. If you look at the utility of ice cream, it's going to be like this. That's like when you were a little kid, and somebody said all you can eat, and you eat like 2 gallons of ice cream and then you threw up. That's negative utility, right? I ate too much, I threw up. So it's still decreasing, but now it's actually negative, right? This is actually satiation. Why does satiation matter? Because there is a limit to how much we can consume and that actually ends up being a problem with the math because then you run into a wall with your mathematical functions.

You're assuming that people will consume an infinite amount, never stopping. But they'll run out. Or you run out of space. Like, how many shoes can you have? Well how big is your closet? Vanelda Marcos even ran out…actually she had what…2000 pairs? Or 12000 pairs? I don't even remember. It was a lot. But she didn't have them all. She ran out after a while. She was the wife of a dictator, and she still ran out…she didn't want that many shoes. She stopped, she satiated. The math is useful, but some of the mathematical assumptions can be autistic.

There's a movement for post-autistic economics. With all due respect to people who are or know autistic people, post-autistic means don't be retarded when you're doing economics, okay? The economics has to match the real world. Post-autistic means: don't do this non-satiation assumption and go out into the world and pretend that you know what you're talking about because there is some satiation at some point. This post-autistic…if you're a skeptic, like I am, you'll love these guys. It started with the French, believe it or not. So let's go to…that's the start of the math stuff.

Okay, we'll go back to that in a minute. Now…back to supply and demand.

So here's some data that I was doing with water. And it showed the price of water, and the gallons per capita per day demand for water. And this is real data from the Bay Area. And the price was $3, and the gallons per capita per day was 50. And the price was $5, and the gallons per capita per day was 100. And the price was $8, and the gallons per capita per day was 200.

I got Q and P, I got 3, 5, and 8. And at 3, I've got 50, and at 5, I've got 100, and at 8, I've got 200. Is that a demand curve or a supply curve? These are different towns here.

Hillsborough…has anybody heard of Hillsborough? Hillsborough is a very wealthy place. Redwood City, not so wealthy…in between whatever. San Mateo. Is that as supply or demand curve there? Supply curve.

But the demand for water in Redwood City at that price. What's going on here? It's not really a supply curve right? If you connect the curve, it's like "Wow, that should be a supply curve."

[Isn't it different for each of those cities]

Yes

[So isn't the difference for those is income…]

Okay, so the difference of those is income in terms of what's going on here. Somebody else? Is there a demand curve? Or is there no demand, or whatever.

What's going on?

[Is it differential pricing, where they're charging different amounts of water depending on how wealthy the place is?]

In a sense, yeah. The price is changing, depending on how wealthy the place is. So does that mean there's more than one supply curve? There's multiple supply curve?

[If it's three different cities, isn't it three different demand curves?]

Yeah. It's just three different demand curves, all right? So this is the demand from a wealthy city. "Someone else said earlier, well this is like income shifting." Absolutely. It's lifestyle water, in a way. If you live in Hillsborough, you've got a big lawn, you've got a pool. If you live in Redwood City, you've got an apartment on a walk-up, okay?

So the point is that, if you see a bunch of dots, you might not be sure if you're seeing demand or supply. If the price from Redwood City falls from 3 to 2…or, sorry let me do it differently. If San Mateo goes from 5 to 4, is San Mateo going to use less water because it's like Redwood City, or is it going to use more water?

Same amount? Maybe. Is that what you asked?

The law of what? Demand!

The law of demand says that you just lower the price. This is why these graphics are helpful sometimes. You lower the quantity and the price goes up. So you'll be moving along the demand curve. You're moving along the demand curve when you lower the price.

This is moving along the demand curve because in this two dimensional representation of supply and demand, we only have two things to work with. We've got quantity, and we've got price. The price and the demand. If the price falls, more quantity. Price rises, demand…what's going to happen? Quantity demanded goes down. If income goes up? What happens with demand? What does it mean, goes up?

Demand goes up or quantity demanded goes up? Not quantity demanded. Demand shifts. It's the most annoying difference because economists are like , "demand falls, demand rises." But you have to be able to differentiate between a shift in demand versus a change in the quantity demanded. And here's what I mean by that.

Forget the supply curve for a second, that's demand. From here to here, what's that called? The change in the quantity demanded, because you are on the same demand curve. This demand curve is…what's that expression "ceteris paribus" mean? All else held equal.

What happens if this demander somehow gets more income? What's going to happen? What kind of change? Shift in the demand curve which way? Out, right?

You shift out. This is assuming that whatever this is, is a normal good. What's it called when it shifts in when you get more income? Inferior good right?

So when you get more income, your demand for expensive cars goes up, and your demand for ramen goes down. Ramen is an inferior good (hopefully, unless you're like, whatever, you have this nostalgia for ramen). $6 bowl of ramen.

So it's important to keep track of the difference between the quantity demanded and the demand curve itself. And I mean it's important because 99% of the people out there don't' know the difference. When you're doing analysis, especially with this logging kind of stuff, keep track of the differences between the shift in demand and the quantity demanded. So besides income, what's another shifter in demand?

[Change in information?]

In what sense?

[Like when the whole low-carb diet thing came out, the shift in the demand for carbohydrates fell.]

That's change in tastes, in a sense. That's what advertising is all about, changing your tastes. Suddenly there's something that you never thought you needed, but now you need it. And so need…that's the word the economists hate: you "want" it. Because you don't necessarily need anything. So demand will shift based on a change in tastes. Tastes can

change for a lot of different reasons. You might wake up in the morning and become a religious convert to not using whatever that product is.

Or the other way around. You might be persuaded by your friend, by advertising, by… you know….you go to the doctor and they say, "You have a tumor, don't use that thing anymore." Another popular example.

What else can shift the demand in and out? Substitutes, and what's the other one? Complements. Pork and Tabasco Sauce. Or barbecue sauce. And I don't know if there's another thing.

[What about expectations of future prices?]

Like a buy now ahead of the future? That would be a question of short run versus long run demand. If you think that prices are going to go up, then it would make all kinds of sense that you would buy more now. Essentially what you have…if you're doing that, you have: time, zero versus time, one.

And you're looking at…you have the same demand and you have a price. And what you're going to do here is you're going to (rationally or not…or in a sense rationally because you know what's going to happen…) if you think that this price is going to go up, you're going to shift your demand out, in order to store whatever you're going to lose. I'm explaining what you said, which is a good example. Anything else? Any other questions on this thing?

[Why is that a shift in demand curve instead of quantity demanded?]

Because the quantity demanded is only affected by the price right now. The future price is not the price now. This P is P zero. But the demand…you say that the demand…F is a function of income. All other goods…we're going to call this expectation, tastes. Tastes and preferences.

This is the symbol for preferences. It's kind of a squiggly. It's not like this, it's actually like that and like that. So that actually means preferences. Don't ask me, that's what we decided. But you'll see it somewhere else. I'm going to say preferences a lot. But if you change your preferences, then you're going to change your demand. If you change the price, you're going to change the quantity demanded.

Kay, good. Good question.

Any other things on this stuff? Okay so supply side…

And what underlies the demand curve? What drives demand, in terms of the way we want to think of how people are looking at the world. What determines a demand? This other concept we use all the time in economics. Not elasticity…utility, right?

Because you have a utility function, you have a demand. Utility doesn't come from demand, demand comes from utility. Because utility, essentially…you have utility from X and that will give you a demand function.

So utility leads to demand, not the other way around.

Moving right along…

So then supply curve. What's the supply curve based on? The marginal cost of producing the product. So the idea essentially is because of diminishing returns to anything…diminishing returns to scale, diminishing returns to management talent, diminishing returns to machinery, any of those things. What it means is that as you increase, the quantity of production…it actually costs more and more per unit of production.

Now we'll get into the theory of the firm and the difference between fixed cost and variable costs. But right now, the supply curve is based on marginal cost. The long-run supply curve is all about marginal costs. There are no fixed costs in the long run. Because the long run is long, right? If your factory lasts 50 years, you're going to have a couple factories. A really long run. So a factory is a marginal cost. It's a variable cost. So this is purely based on a marginal cost curve. What's going to shift the supply curve in and out?

[Change in technology]

Technology. This is the most obvious one. So if you get a new production process, technology will go out. Why would the supply curve shift in?

[Increase in marginal cost to actually go there and get the technology]

Right, no, you're explaining why would it shift out. I'm asking an example of why would it shift in.

[When the cost of production increases?]

Why would the cost of production increase?

[Because your resources become more scarc.e]

Right, potentially. So let's say one of your inputs to your marginal costs is fuel. Oil price goes up, bang. Everything else goes up. I was reading an article about the Canadian tar…they don't call them tar sands…it's politically correct to call them oil sands, right? Because they're…or happy sand.

So happy sand used to…the breakeven point between whether or not you should go into production was that oil was $80 a barrel. And that was because…remember when that $4 gas was happening…there was this massive…the demand was still very high, and producers were all trying to put their fields into production. And if they all put their fields into production, what happens with the demand for inputs? What's an input to oil production? Machinery? What's another input? Labor. Machinery, labor…

[Barrels]

Barrels. Steel Barrels. Can't put it in the barrel, it's not going anywhere. Tankers…

[For oil sands, you need a lot of water]

Water, okay so oil sands in particular, a lot of water. So what happened was when you have this massive increase in demand, is that everybody and their brother was working already in Alberta, for example. And there was still more demand.

So the costs were rising very quickly. In fact unemployment was about 0 percent. Probably 0.1 percent. So that meant that the price of the laborer went from…you know… the price of the truck driver went from 18 dollars to 25 dollars and hour.

Same thing happened with Australia and the minerals. The demand for China with coal and steel, or iron. So because the demand went from here to here, you had this kind of price difference. So the price of oil went higher, and the demand for oil…a substitute for oil is what, from Alberta?

Tar sands. When the demand shifted out for oil, then the price went up, and the demand for tar sands as a substitute good went up, and that meant that it was economic to do it. And that meant that they were pulling in more and more and more of these truck drivers at higher and higher wages until the demand for labor actually went up.

But basically, when oil was really expensive, there was so much demand for labor, that the breakage between going between oil and tar sands was $80 a barrel. Now that the world will have a bit of an economic problem, the costs of all these inputs has fallen. Labor, rubber, trucks. Not even water, but natural gas is another input, has fallen, so the breakeven is now $60.

Now that these fields that were not economics at the end of the boom are now economic again. So that's the cross-price elasticity between oil and tar.

So supply will shift in and out based on technology. And all the other markets. It's the same thing as cross-price elasticity.

Now here's a little footnote for your edification. I've actually worked on this question a lot. And it turns out to be a little confusing for students.

So demand curve…

What's the difference (besides what I wrote up there?)

Which one do we use all the time? The one on the right or the one on the left? The left. But it's called an inverse demand curve. Inverse because it's inverted from this. Because often the quantity demanded is a function of price. You go on the market and say, "Oh, I want an iPhone". Or I want a quart of milk. Or how many quarts of milk do I want? I look at the price, right? You don't go to the market and say, "I want three quarts of milk" and they say, "The price is going to change based on that".

So as a historical accident, we use the inverse demand curve. But really what's going on in demand, is demand is a function of price. Okay, and I want to point this out because a lot of people get confused, and they think…I demand stuff according to what the price is. But in economics, we have quantity down here. This is usually the independent variable.

This is the dependent variable. But it's inverted. That's why we have it here. So the quantity demanded is a function of price. We invert it throughout economics for the sake of convenience. This is easier to use in terms of comparison and graphical stuff. But I want you to know, that this where it's coming from. Just so you know.

It'll be significant if you're doing math and you're trying to aggregate demand from one or two or three people because basically what we do is we say: the quantity of Mr. One: quantity demanded is going to be a function of P. And the quantity of Mr. Two is a function of P also, a different function. G, right? When you want to add those two and get aggregate demand, that'll be accurate right? But then you're going to have to flip it back over again to make P as a function of Q if you want to graph it.

So I'm saying it because 90% of students get tripped up over this addition because they forget to do the inversion. They forget the inversion is tricky. So this is how the world works, and this is how economists present the world (by inverting the world). Which is, again, not a shocker.

Any questions on that? Anything else? Demand/supply?

[Can you go over the q1?]

Q1 is just the demand from individual one. So if you want to aggregate the demand from individuals…here's the way to see it: if you look at the demand here at a price, and then you have someone else's demand at the same price, then it's fairly easy to add these up. And let's just put this here. This is going to be Q. This is Q here. It's easy, just add it up.

If you're going to do demand here, we're going to do it the other way around. And this is Q. so you're adding this way, and that ends up kind of being counterintuitive, when you're adding that way. That's the reason I'm pointing this out.

[So you if you add it up enough, then does the top of the graph say the same? Or does it flatten it out a little bit?]

No this number is not going to be the same as this number. Or the shape will not be the same either.

[But in this graph, if you keep adding quantities, does the top of the graph stay at the same point, or does the shape flatten out a little bit?]

If I keep adding quantity this way you mean?

[Yeah, so the quantity moves past the curve of demand, that mean's that…]

If you just keep adding quantity the demand curve is going to be shifting out. And in fact it's the same thing, but you're adding it a different way. This actually matters for things like public goods, which we'll get to later. And I'm just bringing it up, and you might be saying, "Why do I care about this?" But it's important because we think of the world as consumers, or even as producers. If you have a company, and the going rate of selling cars or iPhones or haircuts…is $14, you're going to say "Ok, I'm going to work this many hours" as a producer. You don't sit there and say, "Oh, I'm going to work 12 hours

and that's going to determine the price". It doesn't happen that way. The only time it really happens is in the market. The market price and quantity are determined jointly. But that's the macro. On the micro level, quantity is a function of price. Whether or not you're a consumer or a producer. But then we invert it when we present it on this scale. Which is counterintuitive to the people who have the math to understand just basic graphing.

So let's go briefly over elasticity. We'll be coming back to supply and demand endlessly. But this is some overview comments as usual.

What does elasticity mean?

[How sensitive you are to prices?]

How sensitive to you are to changes. The general concept of elasticity. Price elasticity is how sensitive you are to price changes. So, the elasticity of demand for pork, is that greater than or less than zero?

The elasticity for demand is greater than zero? Who agrees with that? Who disagrees with that? Who has no idea? Who's too lazy to raise their hand?

Own price elasticity is less than zero. Why is that? Well there's this thing called a demand curve, remember? So let's ask: What does elasticity mean? Let's back up a second. Besides this idea of how responsive you are. How responsive you are is the measure of quantity of elasticity you get. The idea of elasticity is much more simple. It's the change in quantity from a change in price. Quite simple. Calculus, continuous function. And technically, it's at a certain point.

So another way of writing that…here's the simplest version of writing it, sorry. It's the percent change in quantity over the percent change in price.

That's your basic price elasticity. What would income elasticity be?

[Over income]

Over income right? Percent change in income. It's the same idea. It's essentially the responsiveness thing. If something is elastic, is it more or less responsive to inelastic? If the price elasticity is elastic, is that more or less responsive to the price than if it is inelastic? More, right?

Just think of a rubber band. It's a very simple word, and we throw it around a lot but keep it straight. So here's something that's interesting…here's our demand curve, where is elasticity…A B, and C. Which is more elastic? C.

You've got to put up your hand. Who thinks A is more elastic? Nobody.

Who thinks B is more elastic? Nobody. Who's here in this class? Everybody thinks C is more elastic? Is that right? Everybody? You're all wrong.

Which is more elastic? A is more elastic. Why is that? There's the little trick here.

[Is that a Q in the bottom corner? I'm just confused about what's going on the board.]

Okay. That is a Q.

[So that is the demand curve. So you're saying A is the least amount demanded.]

That's right.

[Okay, now I get it]

Now you get it? Awesome.

[Looked kind of like a D and I thought I was lost]

No you're not lost. You're still in Q land. Sorry. That's the bad handwriting strikes back.

A is the most elastic. Think of it for a second. Think about your demand for water. You have this much water. Or whatever. Do you want more water? Do you care about having more water? You've got a swimming pool full of water. But then I say, " You know what, I'm going to cut back your water supply to this."

Are you really excited about getting more water at A? Or are you more excited about getting more water at C. A, right? That's essentially the intuitive argument. The mathematical dQ/dP…P or Q…the math…the change in Q and P is the same because this is linear. It's the same the whole way along there, right? But this is the key part here. As Q goes to zero, what happens to this whole equation? As Q goes to zero, this is the same. What happens to this equation? Goes to infinity right? So as Q goes to zero, elasticity goes to infinity.

At point B, there will be a point B on every linear demand curve, the elasticity is one. It's called unit-elastic. Just because P over Q is one.

I want this to match your intuition. As you have less of something, your responsiveness to price is going to increase. And as you have more of it, your responsiveness is going to decrease. Your responsiveness is different from quantity demanded. But those things are happening at the same time.

What's the elasticity on this curve (Which I'm going to call a constant elasticity curve)? Is it changing like over there? Or is it constant?

It's constant elasticity curve. It's like…is this a trick question or what? Because this is changing now. This is a slope. The reason we use calculus all the time is because it's a slope. So the change in Q change in P…it's very steep over here (you can figure this out on your own). And over here, it's very shallow. Now take that into consideration. If the elasticity is constant on this whole curve here, and over there it used to be inelastic, that curvature is adding (in a sense…this is an intuitive thing, I'm just trying to say it in words)…you're adding elasticity. And here's what I wanted to say with this intuition. If you have this demand curve or this demand curve, which one is more elastic? D2 is more elastic. Because essentially, if you take a one unit price change, the change in quantity is much greater. It's more elastic. There's a bigger response. That's essentially it. okay?

If this was the same person, and the only difference between these two demand curves was short-run vs. long-run…which one is long-run? D2 is the long-run.

In the long-run, things are more elastic, right? You have more time to respond. When I said that factories are a marginal cost in the long run, this is the exact same thing. In the long run, things are more elastic. Think about it. It's a hot day, and you don't have any water. You're probably willing to pay a lot of money for some water. That's a short run phenomenon.

But over a week or a month, you're not willing to pay as much for water, assuming you're still alive. Because you have multiple points of drinking water, right? In the long run, your demand for things is more elastic because you have more choices, more time to respond, more things to substitute, stuff like that. That's the intuition behind here. So that's what we mean by: in the long-run, everything is more elastic. It's a human assumption that economists use in their work all the time.

Go back to that oil example for a second. In the short run, price of oil goes to $140 a barrel. How easy is it to put more oil into production in a day? It's hard. In a month, it's easier. In a year, it's much easier. Not worrying about demand. So if you have more time to adjust to things, that essentially means more elastic. Supply is more elastic over time. Demand is more elastic over time. In fact, everything just flattens out over time. So you'll have one supply and another supply. Which one is more elastic? One or two? One. Good.

And that's why the long run supply curve is drawn like that. Just flat. Perfect adjustability, and it goes straight from price to marginal cost. That's the supply curve. And the short run supply curve: what is that going to look like?

It's going to be straight up. In the short run, supply is fixed, right? A gas station has only a certain amount of gas in the tank today. Tomorrow it can have more. Over a series of years it can have almost an infinite amount of supply. So is this elastic or inelastic. This one here? Inelastic. Perfectly inelastic supply is vertical. Let's call this demand 1 and demand 2. Which one is elastic and inelastic? D2 is elastic, D1 is inelastic right?

Now don't ask me how supply and demand cross here, but that's the idea. That thing's get more elastic over time.

So that's all price elasticity. I was drawing price, price, price, price, price elasticity, right? So cross-price elasticity means what? What does that mean?

You can guess.

[When the demand of one thing changes, it changes the elasticity of another good?]

Almost…it doesn't...

[When the elasticity of one good changes, the elasticity of another substitute…]

Pretty much. Cross-price elasticity means that when price of Good B changes, it affects the demand for good A. If the goods are complements, is cross-price elasticity positive or

negative? If the price of barbecue sauce goes up, does the demand for pork go up or down? Down.

So, change in quantity and the change in price is les than zero for complements. Here's the trick question, what is it for substitutes?

[The opposite]

The opposite, exactly. All I have to do is go with the opposite, right? The change in the demand for pork will go up or down when the price of chicken goes up? The change in demand for pork will go up when the price of chicken goes up. That's positive. That's cross-price elasticity.

Income elasticity? Change in the quantity, change in the income. Is the income elasticity for ramen greater or less than zero? It's greater. Sorry no. It's not greater. When we get more income do we eat more ramen or less ramen? Less. Let's hope. Forget the nostalgia stuff. So it's less than zero when you have an inferior good. That's the entire definition of an inferior good. You're a college graduate now. You know the difference between an inferior good and…what's the opposite? Normal good, right?

And there's this other thing that theoretically exists; it's called a [inaudible]] good? Forget it. Who cares, forget about that. Okay. So that's elasticity for now.

Caveats. Oh yes. Now here's an interesting thing. Remember what I said about the difference between theory and reality? When we measure elasticity, we use this equation. This equation is used for calculating what we call point elasticity. It's elasticity at this point here. And what if I measure and find that it's minus 0.5.

Forget that this is linear for a second. You're an economic analyst and someone pays you $10,000 to estimate the price elasticity for pork, or whatever. What happens (That's your price observation, here) if I say, what's the price elastic for pork here? Is it going to be 0.5? Is it going to be greater than 0.5 or less than 0.5? Greater, in theory. But you never know. It could be going like this, or like that, or like that, or whatever. The problem is when you estimate income elasticity, it's only good in what region? A big region or a small region? Small region. Because you remember that often, calculus, which is what this is, is a point estimate. It's an infinitely small change. An infinitely small change in price and an infinitely small change in quantity. The reason I bring this up is because elasticities get abused a lot. "Oh the elasticity is 0.5, fine. I can use this all the time." No you can't. Some big paradigm shift might happen. So we don't really know the demand curve. We know that it goes downward, but we don't really know what it looks like. And that really matters when you go back to that empirics. I was cautioning you guys on that on Tuesday. So that's annoying if you're actually trying to estimate something important.

Okay so we have a few minutes to go over constrained optimization. Are there any questions on this? No? We'll be back. We're doing consumers over the next lecture.

So let's do this as a quick example of constrained optimization. I get utility from two goods, but it's subject to a budget constraint. The price of X, X plus price of Y, Y, is less

than or equal to my income. If you don't have this, how much do you consume of X and Y?

[As much as you want.]

As much as you want, right? Assuming nonsatiated infinite amounts. Utility comes from this thing here. So constraint…the constraint is this. You only have so much money. You can say you only have the width of your belly. Adam Smith said that. Our demand for food is only limited by the width of our belly. This is the width of our wallet. So we have to find out (I actually put some numbers on here). Let's say the price of X and the price of Y equals 3. And let's say that our income is equal to 10. Now a question on your homework would say, how much of x and y are you going to consume? Its not necessarily obvious how much you're going to consume. What is obvious? Are you going to consume more of x or more of y? More of X. Because relatively speaking, you get the same utility from X, but the price of X is lower.

So this is how we're going to figure this out. We're going to set up a LaGrangian. You should write this down.

[Are you assuming that X and Y give the same marginal utility?]

Yes we do because it's the same superscript. If I had something vague...if I had said U of X …Y equals whatever…there is a function of x and y then who knows? But I'm defining it as a root.

So we do our calculus…we do a derivative with respect to x. We find that ½ of X to the minus ½ minus 2 lambda is equal to zero. This is a first order condition from calculus. Haven't heard that before? You're going to hear it a lot. First order conditions.

We take the derivative with respect to X and we get this. And if you don't like derivatives, now is the time to relearn it. Put this in the front, you take away one, and that's how you get it. Take the derivative with respect to Y equals to ½Y – ½ - 3 lambda equals zero. So you've got two equations and three unknowns, which sucks. So we're going to rewrite this up here so you can see it. It's a little trick.

See it says minus 2 lambda, I'm going to up that on the other side. ½ Y to the -½ equals 3 lambda…divide this equation by that equation. You cancel out the lambdas, so that's convenient. You cancel out the halves, and you get X/Y – ½ = 2/3.

[Where does lambda come from? What is lambda?]

Lambda is just used to make things easier. But it actually represents what's called the shadow price, or shadow value. What lambda tells you is how valuable is more income. How much more utility to you get from more income. We're not going to calculate lambda, but it's giving you an idea of that. So we have this equation now, let's just take each of them to the -2 power. So that cleans up x and y. Equals 9/4. Minus 2 power. Invert it and square it. And then we get X= 9/4 Y. Does that mean you consume more X than Y or less X than Y? More. 9/4 is greater than one. That's what you guys said from the start. The price of X is greater or less than the price of Y. Less, right? Good. We're

doing good in terms of reality. Now what we can do is we can say X is equal to 9/4Y and we can substitute it into the last equation here, which is LaGrangian with respect to lambda. And that gives us this. 2x plus Y equals 10. Minus 10 equals zero. Equals 10. So if we know the 2X + 3Y equals 10, then we can substitute in this and we get

2 (9/4Y) + 3Y = 10.

And then we get 9/2 + 6/2 Y =10.
15/2 Y=10. Invert that. 20/15

Y is equal to 4/3. Y = 4/3. X is 9/4 Y,
X=3.

Do we consume more X or more Y? More X. Like we know we should be doing. That's the solution: that's 100% credit on your homework. You want to show your work, but that's what you want to do. This is the technique in constrained optimization. It makes the algebra or calculus (mostly algebra) work out more easily. It looks like a wreck, but it's a very step-by step, cookbook type of thing. You'll be doing it on homework, you'll be doing it in instruction next week. Have a great weekend.

Transcribed and checked for accuracy by Brynna Bunnag