EEP100 Lecture 8 (Sept 22, 2009)

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Welcome back to a fabulous Tuesday. Who here is worried about homework one?

Who is not worried about homework one?

Okay, I'll talk about homework one as number three. So are there any out standing, not homework one, questions about stuff? That I said in the last lecture? Okay.

Logistics stuff. Homework is still due on Thursday. I'm not going to delay it. I've gotten panicky e-mails. But it's okay, if everybody's panicked, then everybody does the same. Bad grade for everybody. That's why we have curves, okay?

YouTube stuff is still screwed up, sorry about that. The audio file is going up everyday because I control that. YouTube is not controlled by me. The bureaucracy of UC Berkeley. Who has been very helpful. You guy are doing the video, thank you.

So office hours for me: the normal office hours today after class 12:30 to 1:30 and on Thursday is delayed. Obviously it's too late as far as homework is concerned for you guys. Oh no sorry it's changed, not delayed. So after class 12:30-1:30.

So let's get to homework one. First of all, what's going to happen is, you guy are going to hand in your homeworks, the GSI will grade homeworks, I will explain answers during the lecture so you guys can see…

I think we'll talk basically about the most common mistakes, and I'll try to explain those so you guys have an idea. Obviously the homework's are the type of thing we draw on to the exams. So that will help you, in terms of the learning cycle.

This is like a philosophical skid on homework. If you make an effort and if you make your mistake, and you see your mistake, you will actually learn. I am not a big fan of "monkey see monkey do"…kind of cookbook stuff. Because you'll do …"Oh here's what he said, I'll just copy his letters across, and now I've got the answer." You're just doing something else. SO if you're struggling right now, here's my general advice. If you spend more than half an hour on any one problem, if you're crazy (some people give up after five minutes), but if you've spent half an hour, stop. You are definitely now wasting your time. You're going in an endless loop. Talk to each other, talk to your friends, talk to the people next to you, exchange notes. That's fine. If you guys learn from each other, that's fine. There's no problem with cheating. Don't photocopy somebody else's homework. It's dumb, because we'll catch you. And you don't learn anything, because on the midterm, that won't happen.

I have explicit instructions to the GSis not to give you answers on the homework problems; I hope they're not doing that because they're helping you learn.

I've been a GSI in the past and I know that that's the first thing that happens, right?

"Can you just tell me the answer?" No. It's going to be something with star attached to it. This is the answer. That's a bad joke, sorry.

Let's see. So here's some hints. This is where things get interesting right?

Can you use a Lagrangian to solve a utility function that's equal to x plus y?

[No]

Good. Because, as I mentioned in the last lecture, I've got the indifference curves, and then you have a budget constraint. You're going to get a corner solution (very likely) for perfect substitutes.

The reason we use Lagrangian is because we're going to use calculus. You can't use calculus with linear stuff. That's essentially one of those things you figure out after a while. So those of you who might have been thinking that's a good idea, it's not a good idea. That's actually just algebra. Really simple algebra. 4

Or it should make sense. The price of coke is more than the price of Pepsi, and your utility of Coke and Pepsi are the same, they you go buy the Pepsi, because the Pepsi is cheaper than Coke.

Question number three says derive a demand function. That's when you're going to be doing this. This is the demand function. I mean, what does it mean when you have this asterisk? What does that mean in our p star, q star world?

[Equilibrium?]

Kind of. P star Q star is that equilibrium, right? Now what, in terms of economics and efficiency and utility maximization, what's the word that we use when we're doing calculus? We've got this utility function. Oh and when I draw this dot in the parenthesis, that means that there's whole bunch of garbage in there. That means the utility from x, y is equal to blah blah blah. I just short hand; I just put that dot in there. For people who didn't know that math notation, sorry. So if you have utility, and it goes like this…let's just say you're eating ice cream and you're going to throw up, what is this point here? It's the maximum. What's the notation that we're going to put here?

U prime equal to zero?

U prime equal to zero, or, this is also U star. This is optimal U. This is optimal. You're trying to optimize. So when you have a star, you've essentially found a demand function for demand under optimization. And optimization, essentially, is calculus. The whole idea with calculus is where do we find the flat point, right?

If we have the indifference curves that are shaped in what we call a well-behaved, or normal indifference curve, and we have our budget constraint, and then we find this point, what's going on here is that we find this optimal point.

So it's going to be that if we have the bundle x, y, this is going to be x star, y star. Right? That's going to be the optimal bundle according to budget constraint and our indifference curves, right?

So when I say on number three, it's like derive the demand function, you want to derive the demand function under optimal conditions, which means taking derivatives, okay? It's the Lagrangian. Set the Lagrangian, take the derivative, and what you're doing is you're finding where the marginal utility and the marginal cost are equal, right? With the cost being the price. Because the price is not changing for the consumer. So that's hopefully helpful as a hint. But that's what I'm saying.

[Do you we need to take the natural log, or is it not acceptable?]

If it's not easy to take the derivative and it helps to make a transformation of the utility function by using the natural log. So I showed you that as a technique, and I suggest you do that with all kinds of Cobb-Douglas constructs. So if you're utility happens to be something like x one to the alpha, x two to beta, you might want to take a natural log of that.

[You would need to take the natural log of the lambda part as well.]

No. You're transforming the utility function. You just take the natural log of that. Price…you're not taking natural log of prices or anything like that. So this might be confusing.

So say that I have $10, okay? And I go to the exchange office and I get…

Let's see this is the other way around. Say that I have 10 Euros, okay? And I go to the exchange office and I get $14, which happens to be the exchange rate dollars-euros. It's just a transformation. I'm going from one currency to another but I still have, essentially, the same amount of wealth. When you do a transformation of the utility function, you say hey, let's just call this U1 and that one U2. Let's just say this is alpha natural log x plus beta natural log y…this is just a transformation. It's not equal, we're just transforming it into a different kind of units, okay? To make it easier to do the manipulation. If you have 10 Euros and you come to America, you need to transform money into dollars so you could spend the money, right?

But you're just as wealthy having those dollars than having it in Euros. We're just doing this transformation, okay?

Properties of this utility function are the same. You take these indifference curves and those are actually the same. Or they look the same.

So the reason that we use the natural log is just to make the math easier. Okay so transformation. It doesn't alter preferences, it doesn't alter the relationship between x and y because those betas are still intact. Okay? Make sense? More or less? This is the iteration of learning.

[So when we were given as that, the alpha log b minus alpha natural log c, or alpha minus…]

Alpha log b plus…

[One minus alpha c. So that was when you did the intersect for alpha. So to do it for beta do you just switch around the…]

The b and the c were beer and chips. This is x and y.

[Yea, well either way, so for the second, to be respect to..]

According to what you just said, beta is equal to one minus alpha. In that equation.

But the homework is not one minus alpha is beta. If you want to do monkey see, monkey do, you just do that.

And I think the beta is defined as one minus alpha. Don't change all of the letters, because your homework is going to be a mess. "Oh I'm doing this from the lecture…" Just do the homework. Just stick with the beta. You don't have to work from mine. It's simpler…okay number 3 that was the hint.

Number four, elasticity. Cross price elasticity. So all I'm going to point out on this one is that the elasticity, and let's say elasticity at the optimal point, is going to be the change in X1*, change in price 1, price 1, X1*. Just remember what elasticity is.

And it's blindingly obvious. You're going to hate yourself if you spend more than five minutes on it. Unfortunately, the homework is getting you used to the jargon. And the jargon is what all the other professors in all of the other classes want you to know. So it's my job to torture you with all these things that make no sense. Right? Because it's just a word. Why am I spending two hours looking at word? Well because we're just trying to introduce the concepts and work with the concepts. Okidoki? And the cross-price elasticity will fall from…as you work these things out you'll see how things work. Okay?

I hope, we'll find out. So that's the homework. Any other questions on that? Just now? Alright.

The walkout. I'm going to make a teach-in (and it's apparently a popular word in Berkeley).

[Are the rooms going to be open]?

Yeah, the university doesn't care about the walkout.

[Maybe that's just a rumor, but I hear that they're going to barricade the building.]

We'll they'll probably barricade Sproul or the University Admin or something. I want to talk about the walk-out because this is a concept of collective action. Collective action means what? Anybody with a definition?

[A lot of people working together for one common cause.]

Right. And the big problem with collective action is what's called defection. Defectors. Or, in the union word, scabs. Have you guys heard that word scabs before? Okay. So here's how it works classically, rssight?

So you're working for the man. So you guys are all workers, and you're all getting paid. You're only getting paid like $2 an hour. And you're all pissed off. You wish you could make more money. And so you say, "We're going to go on strike."

And so everybody in the room says, "Yeah. We want to make more money. We're going to go on strike." So then you all say, "At 11:10, at class, we're all going to stand outside. We're not going to learn, dammit. Because we're only making $2 an hour."

And obviously these analogies are going to fall apart as we go from learning to union. This is actually going to be really important. So you all stand outside, and you all say, "We're not going to work unless you pay us $4 an hour." And I go outside and I say, "Who wants to work for $3 an hour?" Right? I'll take half of you. The first half of you. The other half of you I'm going to fire. Permanently.

Now you've got a problem. Because some people are going to say, "Damn, $3 an hour is better than $2 an hour. And if I don't go, and someone else goes (this is the dynamics, this is the game theory) then maybe if I don't go, I don't have a job at all, and I could've gotten $3 an hour."

So you do this and someone starts to beat on you. That's why a lot of violence around strikes is actually union workers hitting each other. The scabs…scabs is a term for the people who cross the picket line, right?

They will bring them in from somewhere else and say, "You guys are all hired. We're just bringing in other people because they're unemployed and they want to make money." This is the tradition in organized labor…is to try to prevent scabs from getting to the factory to keep the factory operating. Does that make sense? You guys have heard that from history of economics? So in economics, we just call these defectors. People that detach from collective action, because the benefit to them individually, personally, is greater than the cost to them individually. Although the cost of the group is going to be high. Right? Because if there are no scabs, and everybody holds back, then everybody theoretically can get paid $4 an hour. So if you can enforce discipline so people don't cross the line, and all of you will make more money, then that's the problem. The collective action problem is enforcing discipline. Collective action problem? Climate change. It's like, "Oh, China you stop emitting carbon, America, we're going to drive our SUVs." China's like, "No, you stop first." Right?

So there's this problem of collective action. How do we get each other to slow down carbon emissions? And so it's the same thing again. Now as far as this walk out thing… I'm trying to figure it out. So I walk out, and I stand out there, and I don't teach? I get paid the same, so maybe I should do that, but you guys don't learn, why would you walk out? And if I'm standing here lecturing, it's even worse. Because you have to wait for the YouTube to show up or listen to this miserable audio if you want to do well on the

test. So let's say that we both all agree and we just go walk out, just take a day off. Well did we make any difference to the university administration? Or the politicians in Sacramento? I personally know that they don't care at all. In Oakland? They don't care. They will care if you block their parking place, that's much more important to them. Parking place. But they don't care if you're not learning. So it's really weird to me why there should be a walkout from learning. Let's stop learning and punish ourselves. I don't get it. o I'm not going to walk out. And I'll be here on Thursday. That's the bottom line

[Can I make a comment?]

Yeah, comment.

[As everyone's walking out, there's going to be events on Sproul all day.]

Party. Awesome. Yeah. Let's not learn, let's go have a party. AND we'll pay tuition to have a party. Yeah. Right. I'd rather spend 10 grand on beer than on tuition if I'm not going to learn anything. So I just wanted to give you a reference…go ahead.

[I'm just wondering if you're operating under the notion that the walk out doesn't affect administrators…is that your basis?]

Yes I am. Yes it is. The administrators in Oakland. The UCOP. Sacremento, they're the legislators. I mean, God, talk about dysfunctional, right? Politicians are just like unbelievable to me. As a reference point, I graduated from UCLA in 1991. My tuition was the equivalent of $3000 today, right? So you're tuition is essentially triple that. And people are like hey, dammit, we're paying more money. And who wants to pay more money? That's essentially the idea. Fees are going up…they're going to go up to 10 grand next year, right? Who wants to pay more money? And I agree with you. Who does, right? But as an economist I have to ask the big question, right?

Which way does this equation go for you as students? Is it worthwhile to get a four year degree, five year degree, to get a degree? Versus tuition.

Yeah.

Yeah, because I like to learn maybe. In the long run. Does anybody know the net…I looked this up…yeah?

[The whole point about the walkout and the fee increase isn't about us; it's limiting access to incoming freshmen because it's going to cause less freshmen to come to Berkeley. And also it's going to increase the money.]

Decrease diversity, not necessarily, increase cost of education, definitely, right? Price is going up? There's the demand curve, right? That's absolutely true. Now, does anybody know what the degree of subsidy is? To your education? Right now? 60-70% subsidized by the taxpayers. Hopefully. Maybe if you're not…from out of state or from out of country, there's still a subsidy. Believe it or not, you pay 25 grand tuition if you're from out of state. Does anybody have the number? 30?

You pay 30 grand. When I looked at it, it was 25, and there was still a 20% subsidy from someone out of state who's not a Californian. Who doesn't deserve it. People who are in state, you're getting a crazy subsidy. Really nice. Go to Stanford and pay 35,000, 50,000, whatever the hell it is, right? Stanford and Berkeley, besides being equal in football, are equal academically.

[But that subsidy can't be necessarily viewed as a…I mean the way it's viewed is an investment in the future because what if you don't subsidize education? You end up with a lot of uneducated people and that's not good for economic…]

That's a political justification for taxpayers subsidizing you guys, right? But this is my question. What's your marginal cost?   What your marginal cost is tuition? 10 grand even. Forget the cost of living—apartments and rent, stuff like that. Your marginal cost of tuition, 10 thousand dollars, and if I make it 50 thousand dollars over the course of my education at Berkeley, am I going to make more than 50 thousand dollars in two things: one is money, and the other is happiness, right? Because I'm an educated person. I learned something. Some people actually rather skip it. They just want to pay 50 grand, and go be a secretary, making whatever it is…50 grand a year. The net present value of a college degree in the United States is $170,000. Does anybody know what the definition of net present value is?

A little more accounting than you wanted. It is the sum (this is the summation sign) across all time of the change in income from year 1. The change in income from year 2. And so on, until you retire. The difference in income you're going to get year, by year, by year. They're all discounted by a discount factor (we're going to get to discount factors later, that's a delta). They're all discounted. Delta one to delta to the r power. It's discounted back to present value. The net is the difference. The present is adjusted for time, inflation, and value of your education is positive, right? And that's the idea. Why do you get education? Because I'll make more money, and maybe because I'll be happier. Hopefully both.

[You're saying the extra money you get from getting an education, if you put it in terms of dollars per day, is $170,000]

Your lifetime career earnings will be higher by a 170,000 dollar difference. So basically, if I said today, you're on path. You're going to choose between going this way (and remember this has nothing to do with social welfare, actually an additional to 170 it's about a 100,000 social welfare that goes to everybody else in society because you're smarter than you would've been). That justifies the subsidy, but the subsidy goes to you as an individual. There's this fork in the road. You go this way, you get 170,000 dollars more. That's education…a bachelor's degree. If you go this way, you're essentially zero dollars more. You're a high school graduate.

[I'm not questioning your numbers or anything, but doesn't 170,000 seem really low?]

It seems really low to me. And we see this number across the entire United States. I mean there's actually really useful studies…like…a Harvard degree is worth nothing more than a Berkeley degree. But it costs a lot more. Right? So in that sense then

you're super smart. Because you're actually paying 10 grand to get a 50,000 dollar education.

[That 170, does it take into account the amount loss of working 4 to 5 years instead of earning that degree?

Yeah. Net present value. Foregone earnings included.

[So are you saying that you don't have a problem with fee increases to students?]

Right. So two reasons. So here's the thing, We all want something free or cheap right? I talked to this guy. Super free market guy. What is up with subsidies? And this guy, Bruce Yanlon, he's this really genius political economy guy, and he said, "You know, I really hate subsidies unless they go to me."

Essentially…you all can quit right now. Save that 10,000 dollars. You can go work at the coffee shop for $10 an hour and you get an extra 5 years of profits at $10 an hour, and then the rest of your life. We hope as a rational individual you are choosing to be here because the value to you is greater than the cost to you. In time and in money. Now I completely agree that you all want it to be for less money, but the problem is that this entire financial system in the state is broken. So they're trying to pass more of the cost of education to you instead of the general fund.

Well, it's just like with taxes, you have low services, low taxes, high services, high taxes. But this is high tuition low service. It's not like high tuition, high service where we're all fat and happy and we're going to …

I look out there and I see this horrible, ghetto campus. Oh my God, that library sucks! Three books!

I mean like thirty percent of classes cut this year?

I don't know, I've got one class. That's all I've got.

[During finals they're not going to be open 24 hours any more.]

[And Saturdays.]

Saturdays!

[How many people didn't get into this class that wanted to take this class?]

I don't know, I wanted them all in here.

Here's the thing, demand is unlimited…the lower the cost goes, the higher the demand. Let's lower the tuition to $2000, then you'll have like 400 people trying to get into this class.   Wait what do I want here?

[Well demand's going to be lower if we're not getting what we want. Getting our money's worth.]

Demand is going to get lower…you're mixing up concepts here. Question? New hand, new hand. And I'm going to stop this teach-in in a few minutes.

Can you explain why it wouldn't affect diversity if financial aid…is it financial aid…?

It's going to affect diversity from the perspective that economic buying power and diversity are related. And they are. I hate racial trap, but I'm a big believer in financial aid to poor people…no matter what color, disability, or whatever. So the diversity thing I agree with, but I would target economically challenged people, not skin-challenged people. Right? That's ridiculous. Next?

[A lot of argument for why people should have this walk is really because they say that UC has like some billion dollars in reserve and they're not using it, instead they're raising costs and raising tuition. So they're hoping to raise that alarm so we can reach in and stop doing that.]

To spend their reserves? So the reserve is there, presumably, for some reason. The UC Bureaucracy is crazy. Bureaucracy everywhere. Suck up money and spend it on bullshit, right? You look at these numbers. If you look at headcount, I'm going to put x employees, and you look at time, and you look at lecturers or teachers or whatever, and then you look at admins, and it's like this. A bunch of paper pushers. And that, to me, is a waste of money. The paper pusher thing. There's actually really interesting economic papers on this. The struggle between administrators, students, and professors. And professors, teachers, right? So I'm happy…yeah, let's cut all the secretaries. I don't know what the hell they're doing for me. Except when the lights go off. Another question, yeah?

[Just a comment. The walkout, from my understanding of what we've gone to, is the beginning of what the previous comment stressed upon, the beginning of a discussion with the UC Administrators, and this is how it's going to go: well, why don't you cut here, why don't you take this money out.]

I'm not a big fan of temper tantrums as a way of discussing things.

[I don't think that it will be a temper tantrum…]

The walkout is a what?

The walkout, I don't personally…

You consider that a constructive dialogue

Well there will…with the teach-ins Wednesday and Thursday night…

Okay, so teach-ins, that's fine. But honestly, I mean…I was thinking this walkout…the analogy is the Rodney King trial and then he was convicted. Or no. The policemen beat him up. And then there were riots in LA. And this is a typical pattern. Let's have a riot, let's burn down our houses. Or the merchants we buy stuff from. And that never made sense to me, because you burn down the assets of your own neighborhood. If you want to go riot, go to Sacramento, and annoy the legislators. Go do it in Oakland, don't do it on

Sproul. I know it's convenient for the commuters, or the people on bicycles, but go to Oakland and picket there. They'll be much more upset about losing their parking places or their lunch time break. That'll get their attention, right? Then you can start dialoguing. Last question? Last comment?

You want to bid? A dollar, two dollars?

[I've got a homework question.]

On the homework? No, hold on.

The homework??

[[*I think this really is a time to show force to potentially to summon an equally bargaining power…]*

I don't know. It's supposed to be a force of numbers, and there's many people shouting outside my window. Make them go away.

Right, because if you don't have equal bargaining power you're…

You guys don't have equal bargaining power.

[I'm just saying…]

It's a bureaucracy.

You know how to do that? Go to Stanford. Right?

[So what do you propose?]

What do I propose? I would propose sending e-mails to administrators and annoying them with your concerns. See there's no traction. "We don't want to pay money" is not a negotiating position.

[I don't think that that's the position.]

Well "use your reserves" is also not a negotiating position.

[I agree, and I understand that in a sense we'll all have to pay a little more, but if they can [inaudible] to 25%, that'll help…]

That's the same argument. "I don't want to pay money."

Okay, shutting down, shutting down. Teach in over. That was my opinion. We'll get back to collective action later in the semester. And then you'll have lots of new tools to get your fees lowered.

There's a homework question?

[Yeah, on number 6, can you use the Lagrange to solve…]

Can you use the Lagrangian to solve Leontief?

[No]

No. There's your answer. Okay, so let's go to production.

Why can't you use Lagrangian to solve Leontief? Because they're perfect substitutes. That's a circular answer. Why can't you use it?

There's no function to optimize. To differentiate. That's a great answer. There's not tangent line at a minimum/maximum situation.

Just as a graphic representation of that: This is tangent, this is tangent, that's tangent, right?

There's infinite tangencies to a point. Lagrangian's about points.

Production. Just as an example of production technology, I'm going to torture you with this notation again. So Q of dot equals a function of L and K equals, for example, Labor and Capital. L to the alpha, K to the beta, okay?

[I have a question about these exponents. So do these exponents always have to add up to one?]

No.

[So they can be bigger…]

This is going to get you on number eight, but here's your cheat sheet.   Alpha plus beta equals one is constant returns to scale. Alpha plus beta greater than one is increasing returns to scale. Alpha plus beta less than one is decreasing returns to scale. Remember this thing that we had (and this is what I'm talking about right now, this depression)?

For the sake of convenience, let's just use this Q of L. L as labor, okay? Q is a function of labor. As I add labor, what's the line going to look like (think calculus) if we have constant returns to scale? Straight line. It's a linear thing. It's constant.

I'm actually going to bring 8, and we're going to do 8 right now. So this is constant returns to scale. What is it going to be like with increasing returns to scale? Draw it in the air, do your air drawings.

Not exactly, that's marginal. Like that right? This is decreasing returns to scale. You were doing falling. That's the marginal return.

This is going to be Q prime. Decreasing returns to scale is like this. Constant returns to scale. And let me ask you, what's increasing returns to scale going to look like?

It's going to be going up, right? Awesome.

IRS, the only time we like those letters.

So this is essentially the description of the technology. You've got your laborers. Think of it in example of the coffee shop. You've got one coffee machine, you've got your machine, and you've got your three slots, and you've got your one barista, and one barista, you could be on…

This is going to be constant returns to scale. You've got one presser that's making the coffee and one person, right?

If you add a second spigot, you've got increasing returns to scale, because now the guy can work two of them at the same time. And say you have a third one.

But now, say that you have constant returns to scale, and you have another barista, and then you have a fourth person, because you're doing the full employment act, for green jobs, and you've got five people, and you've got six people, and after a while you've got soviet proportions. You've got ten people and three spigots. And one guy packing the coffee and handing it to the next guy. And the next guy's looking at the coffee, handing it to the next guy, and the next guy puts it on, and the next guy goes over here and pushes the button. That's decreasing returns to scale.

For each additional worker you add, you're not adding very much productivity. That's really what we mean.

[So does every constant returns to scale eventually become decreasing returns to scale?]

This is the big question, right? So what pattern typically happens as we just do labor, and we're going to do output, right?

The idea is that you're going to have increasing returns, and then constant returns, and then decreasing returns. Right?

That's a typical pattern, right?

Now this is an interesting to look at. Oh sorry, that's…

All this is saying here is that you are producing less stuff with more people, which is kind of crazy, right? You should just fire those people, because you're actually producing less, right? Now on the margin it makes more sense. The marginal cost of production is falling. You can actually have a negative effect on output by inputing more labor. They actually are tripping over each other.

Your laborers. Just imagine some kind of Keystone Cops kind of comedy, right? Or if you add a whole bunch of new trainees to the coffee shop, right? Negative. Because no one knows what the hell is going on. They put the mocha in the cappuccino, and you have to throw away a drink, and then…

Just think fairly commonsensical ideas. If I throw more people in, am I going to get more output but not falling, or am I going to get falling output? This is called very unprofitable stuff. This will eventually happen though, if you don't have a pricing signal.   You have this…let's employ everybody signal.

So look at the quantity here. I'm going to erase this thing here.

And I want to draw a connection here between output and costs.

If I have…I'm putting quantity here, and I'm putting total cost here. If I have decreasing returns to scale, what does total cost look like as I have more output?

What you have to do kind of is to flip these axes around. See the Q is on the vertical, and Q is going down to the horizontal, right?

What is it going to look like? Increasing at an increasing rate. So this is decreasing returns to scale, more or less.

[Sorry, that means you have more what?]

As you have more output, your costs are rising at a rising rate. Right? So that's total cost. And you can just draw the analogous increasing returns to scale and the very useful constant returns to scale.

So this is the total costs that are incurred by the firm. Does that make sense on a fairly intuitive basis? I mean, think of labor costs being constant. Every person you're paying with $10 an hour or something..

You can just change the Ls with K for capital, or fine. If you do it for capital and labor… if you have both of them we're doing three dimensions. And they we'll get this three dimensional chap that's kind of going like…

Three dimensions…decreasing returns to scale…so instead of having just this, you're having this whole…the interaction between capital and labor.

And it depends on the substitution between these two factors. Just keep in mind that you can have substitutes or complements. There's tradeoffs going on, but you're still having that general shape. Does that make sense?

And anybody who's running the firm, the entrepreneur that's running the firm, who could be at the capital in a way, right?

Your entrepreneur is strained and stressed, and after a while, running around…

It's like Bill Gates could not run Microsoft unless you start delegating, and delegating, and delegating the authority. And the lower the quality of the authority, the less efficiency from each manager is going to happen.

That's going to be why big organizations stop growing at some point. Sometimes they explode, because they have no idea what they're doing. So if you add capital and labor, you're going to have these three dimensions. I'm not even going to bother, right? But typically you have this typical…you put a K out there in the z-axis. But the analogy should be very strong in your mind in terms of using one input. Make sense? Questions on that?

This is just to get an idea of the relationship between production and costs. Now if you're looking at total costs, quantity, let's put two things on here. Total revenue and total cost. And we're using decreasing returns to scale technology, which I'm going to assume a lot. I'm just going to assume this all the time. Total cost curve. And total cost… another way of writing this is C is a function of Q.

Is that quantity over cost?

No, no, no, they're both on the axis. They're sharing the same axis.

If you're a price taking firm, what would your total revenue curve look like as your sales go up by two?

Increasing at a decreasing rate?

No, if you're a perfectly competitive firm. You're a price taking firm.

Linear?

Linear. Yeah. Linear, and the slope is what?

One.

Or P. As I go up one unit of 2, I go up by P. Rise over run. Is that P? Because you're price taking, right? Every unit you're going to sell. I sell one, I get one P. If I sell two, I get two P. Does that make sense?

It's very straightforward. The algebra is this.

When I say it's very straightforward, I'm hoping it's straightforward. It's a bit confusing.

Then all of this—this is all of the jargon that I said you're going to hate but you're going to need. And as you understand it, it will help you…

And bring in your analogies from the real world. As you understand it, you'll understand how things fit together if I do a good job.

So the straight line is total revenue?

Yes it is, right? So if I wanted to talk about the profit of the firms, it's going to be total revenue minus total cost. We're going to elaborate on it, but it's basic right. I get $1 million in revenue, I've got 900,000 in costs. My profit is 100,000 right?

It's just an accounting identity. In this case, profit equals price time quantity minus c of Q. okay?

Now guess what I'm trying to do next? Optimization right? What am I going to do next.

Quantity, right? It's either p or p* minus

And what am I going to set it equal to? To maximum. They're not a problem because essentially I

Now is A where I'm maximizing profits? Who thinks it's A? It's either A or not A so you all have to raise your hands.

Not A? A? Not A? Everybody raise your hand dammit. Raise your hand, let's see…

You want A? Okay good it's not A.   why? Who said not A?

[Because you break even.]

Because you break even right? You're total revenue at this point and your total cost at this point are equal. That means you're making zero profit.

Now here's the tricky part, where is profit maximization occurring?

No, that's where revenue is happening. Maximization.

The difference is greatest. That's a very intuitive and very correct answer. But more importantly, let's just call it where these two lines are tangent to each other.

And I'm going to draw that marginal revenue vs. marginal cost. If I take a derivative of those two curves.

Now Marginal Revenue is for price taking firms; what is marginal revenue for each unit sold? I sell a unit what do I make?

Price

Price. I sell another unit, what do I make?

Another P.

Another P, right? Marginal revenue is actually equal to p. and no matter how much I sell, I always make P. Just a straight, flat line.

What does marginal cost look like for this firm? Sorry do you have a question?

[inaudible]

Perfectly elastic. So when you say…the question is…in the long run, supply is flat. Is that inelastic or perfectly inelastic? Anyone? This is now we're in a market place, this is a supply curve. Is that elastic supply or inelastic supply?

[Elastic.]

Inelastic supply is like that. Does that answer your question?

Essentially no matter what happens to the price (remember the definition of elasticity to Q, b, p. That's quantity supplied, p over q. No matter what price, quantity supplied doesn't change.   Not zero, it's just infinite because it's just a flat line. I guess that's how it would work out.

A perfectly elastic supply curve is essentially useful for examining the long run cost of any good from an industry, right? So that's what that is.

Back to the firm, what does marginal cost curve look like when you have decreasing returns to scale?

Here it's increasing at a decreasing rate; what's the derivative of this? Positive, yeah. It's helpful to have an example. So let's say this is Q squared, right? The derivative of Q squared is…?

2Q, which is linear. And hopefully, it rises at two for every one. Let's call it that.

Where's the point of profit maximization for this firm.

Sorry?

For the derivative of profit, is that p minus q prime times q, or is it p prime of q.

Sorry, p prime q. that's a good point. That was a mistake.

Why is marginal cost curve linear?

It depends. I just asked for the…this is the cost function. So it's q squared, and the derivative is linear, right? But I will make the assumption of that the marginal cost is linear. So it's increasing, right?

So because it's…if you remember the…when we draw most of the supply curves, supply and demand? This is demand, but what is it also equal to? Did I tell you guys? Equal to what? A consumer. A demand for a good is based on the consumer's what? Preferences. Preferences go to?

Utility.

And this demand curve is what? Is it utility or is it some kind of…

Marginal utility

Marginal utility, right? That roughly will do. That basically is a transformation of marginal utility. The supply curve is based on what?

Marginal cost, right? So when we draw, roughly equal to marginal cost. It could be exactly the marginal cost. That's the analogy. You want to think of marginal cost. So this is a flat supply curve, right?

But when we draw the classical axis, the supply and demand, that's essentially increasing marginal costs. Right?

And it works almost all the time in terms of looking out there into the world. And you're looking…you know, you go to the supermarket and you buy tomatoes and the marginal cost of tomatoes to you is the same. But the aggregate demand of tomatoes is…it goes from 2000 tons a day to 3000 tons a day. You're not using tons.

But aggregate demand goes up, and the cost of tomatoes is going to go up. After awhile you're going to be doing hydroponic tomatoes in dorms, right? Okay so…(because they're more profitable than other crops)

Any other questions about…?

So that's that.

What's profit maximization over here?

The intersection, right? This is economics, where things cross, this is Q star. Right? You set it equal to zero because marginal revenue minus marginal cost equals zero. Or your marginal revenue equals marginal cost.

So this total revenue, total cost figure here? It is identical to this, because I'm explaining two different concepts. That's total and this is marginal. Right? Total it's like the derivative, get the marginal, make sense? Okay.

Now if the firm…if the consequence to a firm…the total cost is composed of marginal costs, what else also? Fixed costs, brilliant. Now we're getting a little bit more into costs. Which is kind of straightforward stuff. We're mixing up all these things right here. So a cost If you're going to start a company (your fixed costs, your variable costs, your)

These are accounting profits in economics. I'll get to the accounting profits and economic profits.

Average costs are equal to what?

You saw this guy in your other econ class? Okay, intro? Okay good. That'll make this easier to pick up. So let's draw some pictures.

If I have a fixed cost greater than zero…what is the shape of the average cost curve? What's the shape of that one as I add on more quantity?

It goes down…it's starts off at infinity and then it goes down like that. Because essentially you are taking a fixed number and you're dividing it by a larger and larger number. As two goes to infinity, average fixed cost

Why does it start at infinity? Wouldn't it start at whatever it was?

No, no, no, this is average. Average fixed cost. And if quantity is zero, the average is what? The average fixed cost…so it's a number. 12. 12 divided by zero is? A big, big, big number right? Infinity right?

12 divided by infinity is a very little, little number. Right? Zero.

It helps to think of these things…what's zero and what's infinity. And then you can kind of connect the dots in between.

So that's what happens. And this is called "spreading your fixed costs over your sales", right? This is how General Motors used to sell more cars in order to distribute the fixed

costs: the pension, the factories, the overhead. The university of California has to have more students to distribute the costs of its administration across more and more and more students. So we have more and more students, but then now wait a second. Now the average library space per student is falling, and now you're upset. There's this balancing act going back and forth. But average fixed cost would be falling. Now we can combine this idea with average variable cost.

Decreasing returns to scale: variable costs over q are going to be…

The variable costs when your production is zero is going to be what? Zero right? You don't have this, you don't have anything.

With decreasing returns to scale, it goes up at a…?

It's increasing at a decreasing rate. Marginal costs is variable.

The average variable costs and variable costs are identical. It kind of makes sense. So here's the difference. Do it that way. No…

Average variable costs are total variable costs divided by Q. The difference is I am looking at total averages…total variable cost…this accounting stuff drives me crazy.

Isn't the average cost and variable cost always…they're the same?

No, it won't stay the same. The variable cost at zero is zero. And is you increase quantity, variable cost is increasing.

Is it like that?

Like a straight line? No because that would be constant returns to scale.

Isn't it the same shape, but…

It's the same shape as the variable cost curve or the marginal cost curve. At the moment let's assume that it's the same shape as the marginal cost curve. If I'm wrong, send me an e-mail, I'll give you a bonus point.

So here's what's interesting…let's combine these two curves. When you do have fixed costs, and when you do have variable costs, what's that shape look like (generally speaking)?

Yeah, right? As you combine that and that, and you get one of these. Now let's put price on this axis, here. Price taking firm, where's the point of profit maximization?

At C, my average cost equals price, right? Average cost times Q equals P times Q. Total cost equals total revenue. Profit equals…zero, right? What's your second guess? B, right?

It's one those tangent things again. The gap between average cost and average revenue (price) is maximized.

Now in terms of increasing returns to scale and decreasing returns to scale, at point A, is the firm facing increasing returns to scale or decreasing returns to scale?

Increasing.

Increasing. Falling costs. Falling variable costs.

Is point C increasing or decreasing?

Decreasing.

Decreasing, right? The inflection point (calculus) is here.

What the hell is going on with this one?   Did the firm ever stop producing? What's the profit maximization point? Infinity. It's like forever. Does your price ever increase?

Questions?

Is that a parabola then?

A parabola? Sure. Doesn't matter to me. We're not doing parabolas here. The shape is a parabola. It's a tooth bowl as far as I'm concerned. And it doesn't matter what shape it is. Okay next question.

Then you want to be operating at point C right?

You want to be operating at point C—right/wrong? How much profit do you make at point C?

Zero.

Zero. You just gave away all your profits.

But I remember in EEP1, they were saying that as long as your average cost is below your price line [Inaudible]

Right, right. But average and marginal are different. This is average cost, not marginal cost, right?

Let's draw what I think that you're talking about.

It looks just like that.

I know it sucks. All these curves, and they all look the same. So here's price, here's marginal cost.

Yeah we can do this for marginal cost. And if we have price here, and this is marginal cost (marginal cost is falling). Marginal cost bottoms out, and marginal cost is increasing, right?

And this is actually the profit maximizing point. Because your marginal cost of a unit at this price is equal to price.

Below this marginal cost is less than the price. You should produce one more. You should not produce above here because your marginal cost is above your price. A more conventional way of looking at that is probably…

Well, demand, right? And supply. And this is your marginal cost curve.

This is what we usually look at. These axes here; this is what you usually look at. This part here, we usually ignore. Why do we ignore that? Would your firm produce in this area? Falling marginal cost?

You keep producing, keep producing, and you produce until your market…you can say, "Oh look! Marginal cost is equal to price! I should produce at that point!"

That's like, dumb. Your costs are fine, you can make a profit on all these units all the way up to here, right?

So what does that point tell you?

This is the minimal marginal cost, and it tells you where you switch from increasing returns to scale to decreasing returns to scale. But you can get to decreasing returns to scale; you're getting less and less efficient, but you're still making money. That's okay. As long as your price is above marginal cost.

Is that optimal marginal profit?

Optimal marginal profit, right? But you want it to go to optimal marginal profit equals zero. Marginal revenue minus marginal cost is zero. Yeah, so that's where you're going to be the most profitable.

So this is actually, if you think about it, this could end up being where you're like happiest, or whatever, but if you want to squeeze every last drop out of your production you go all the way to the end.

So you're saying that optimal is at C and that most people produce at C.

Here?

No, C. You're talking about this graph here right?

So you're saying optimal is?

Optimal is C? And then where firms produce is C?

No, I will not say where firms produce is C. That's an economic breakeven, right? So you should not produce beyond B. We assume, if you're a profit-maximizing firm, you'll stop at B. Essentially what you're doing, because this is average cost, now I'm getting confused with these curves. But what you're doing as you go beyond B, your cost across all units. That's a total cost…you're average cost is increasing. Essentially, you're producing, you're losing money in all the units you just made. You should stop right here at B. That's optimal.

But the question of where should I stop as a firm? So that's why you want to keep straight…you know…you're looking at average or marginal. Because average is the curve for all units. Marginal is that last, last unit.

That's why you stop at where marginal revenue equals marginal cost or where average cost is minimized against price.

Shouldn't you stop right under C then, because you…

If you stop here? Okay, so what happens here. Your revenue box, you stop here, then these are costs, and revenue is that box plus this little bit here. Over here is your profit.

But if you stop here (now I'm going to screw up this whole thing) now that's your profit. It's a much bigger area.

So what you just said is that the point B on this graph is [inaudible]. So point B is profit maximizing.

Point B is not an important letter. I'm just throwing it on there, okay?   B and B are the same. This one is talking about marginal cost curve. This one here is average cost curve.

If you can draw the marginal cost curve onto that one, it would cross where B is?

Yep, that's what we get.

So you can draw them on the same graph.

Which I should've done, but I didn't, because I suck.

Okay so price, marginal cost. I'm going to call it point B for some reason. Now what I want…

Okay so when we say fixed cost, how does that affect the optimization decision of the firm? Does the firm decide how much quantity is produced based on fixed costs?

No.

Because why?

Because with quantity, the fixed cost doesn't change.

Always the same. What's the economic word…

Sunk cost.

Sunk cost. And if you think about it…you've got profit equals total revenue minus fixed cost – C of Q. Just to make it obvious, if I take the derivative of this, what happens to Q?

Gone.

It goes away. There is no decision. There is no optimization decision when you do a change in quantity. Right? So fixed costs are there. The only thing that matters in terms of fixed cost is what? In terms of the firms staying in business?

Can you repeat that again?

What's the only thing that matters in terms of fixed cost and the firms staying in business?

You're going to make more than fixed cost, right? Your total profit has to be…

Your revenue has to be greater than your fixed cost (plus your variable cost, okay we know that). But your total profit from producing widgets has got to be greater than the fixed cost of setting up the firm. Right? Because basically the idea in economics is: if the costs a million dollars to set up a firm, and you're going to sell 10 units, and you're going to make $10 of profit on those ten units, could you sell it for two?

Let me write this out. So fixed cost is 100. Price is equal to two. Variable cost is equal to one.   Q is equal to 10. Is that a good business to run? To enter into?

No, right? You sell 10 units, you make 20 minus 10, you make 10 dollars of profit against 100 dollars of cost. You've just lost 90 dollars. Right? They said this thing about…the easiest way to make a million dollars in the wine-making business is to start with a billion dollars and then buy a winery. Because you will lose money like crazy.   I think George Bush's business tended to work like this before he came president.

So…I'm not flagging George Bush all the time, except when he deserves it. So this is why fixed costs matter. So once this decision is taken into account (And sometimes this is difficult because you go down the road and bang, you have this massive cost). But you know that this is going in, and this is equal to 100, or more importantly it's equal to 1000. Like 100 you break even, 1000 you have profits, so that's the business you want to get into.

So how would you even decide that setting up a business? But you don't know what the price is going to be in two years? You don't know what your marginal cost is going to be.

You're sitting there and you've got a million dollars and you're saying: I want to invest in the business, and you look at… "I want to open a McDonalds franchise."

And this is the kind of numbers you should know as a franchisee. If you're an entrepreneur, you have no idea. Because you're an entrepreneur, you're like, "I don't have much time to sell it, at all…what Q is...you're an entrepreneur, you don't know this or this, and you pretty much don't even know this. Right? Because you're starting a new business."

But if you're McDonalds, they'll tell you this and this and this and this. Or Starbucks. That's why there's like 6,000 Starbucks. Right? Because hopefully they're making a profit. Or they shut down if they don't.

[So then how does average cost fit into this example?]

That's what I'm getting to. So let's just do it this way. Because we want this to be the same B. This is a rough way of relating these two ideas, right? Because you go out here, that's notorious C, and your marginal costs are so high. Now the areas under the curves are useful also. Just to extend the analogy. The area under the marginal cost curve at point C (your integral, right) is equal to what? The area under the curve.

These are all per units. At point C am I making a profit or not? No, right? If I'm not making a profit then total revenue is equal to what? What's it equal in terms of…one thing multiplied by another here?

Point C is equal to what? P times Qz. Right? Minus the area under the average cost curve. Right? Marginal cost at point C.

The area under this total rectangle is my total revenue. And the integral is my total cost. The sum of all marginal cost is the total cost. Or, if you wanted to, you could say AC at (which is equivalent, right? That's worth pointing out here.) AC at point C times Qc. These two numbers are the same at point C.

That's just the integral. The area under the…I'm not even using the notation right. Zero to Qc. Awesome.

It doesn't take into account the fixed costs.

It does not include the fixed costs. We have it in here too, right? So actually, that's a good question because the marginal cost curve is not going to be the total. The fixed cost will be part of that total.

That's a very important point. And I am wrong. And that is…there's no fixed cost because it's a chunk, right? So the integral of the marginal cost curve from zero to Qc is some number less than the total cost.

That's variable cost and Qc.

So where did you get that number from? The area under, from AC upwards.

No the average cost at point C is this value here times Q.

Well the area of both are from the MC curve down to Q.

The area under the marginal cost curve is total variable cost.

Ok, so the area from where to where?   To Q or to Q prime.

To Q. Under the whole curve.

Are you integrating? With respect to what?

I'm just taking area under the curve.

Integrating under the curve with respect to Q? I guess? I don't know.

Last question? Last question anyone? Or else I'm going to take this and let it go.

[The price is the point between price and average cost?]

The price is not changing. The optimal price is where the difference between price and average cost is greatest or where marginal cost and marginal revenue equal.

Okay, thank you, office hours now, and I'll answer your questions all the way up to my office.

Homework is due in the start of class on Thursday.

Transcribed and checked for accuracy by Brynna Bunnag