

EEP100 Lecture 9 (Sep 29, 2009)

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So congratulations for handing in your homework. The good news is it's only 5 points of your grade. No, the good news is that it's done. The bad news is that now Diana and Fei have to grade it.

Let me go through some logistical stuff and then we'll get on to more lecture stuff. First of all, any outstanding questions? Like, oh, please explain the economic recovery package to me? Nothing? Anything out there right now? Yes.

[Do you have another blog called the Great Recession Conspiracy or something like that?]

The Great Recession Conspiracy is a book written by the friend of mine and he made me the coauthor. And I said, "Alright, fine." So he runs that blog. I actually have literally never looked at that blog. But if you enjoy it, then go for it. Because I've been doing a lot of political economy, I've been paying attention to that particular macroeconomy aspect; the idea of Henry Paulsen calling his buddy at Goldman Sachs and asking what?

We don't know. We have the idea that they have a conversation, so this is all about the bailout and Wall Street and Main Street, and all that. So if Henry Paulsen, who I think was the head of Goldman, goes in to work for the government, and the government has a package that happens to benefit Goldman a little bit better than Merrill Lynch or Lehman Brothers, which is bankrupt now. Then is that because Goldman Sachs is actually a firm better deserving of that outcome because they're just more clever than everybody else, or is it because Henry Paulsen is their friend? So the conspiracy theories about Wall Street revolve around the interactions of friendships and personalities and the typical back channel connection between politics and economics.

There's actually a book; you can buy it for \$4.95, I've read through it; I agree with 80% of it, and I'm a co-author of it, but I didn't write it. So that's that blog. Enjoy it, and if you have questions about it, go ahead and bring it up. And remember when I said (earlier in the class) that there's a difference between the natural state (where politics and economics interact with each other). Remember that? I said who's from a developing country or something like that? That's what's going on here. The idea that...that's what could be going on here. The idea that political connections will get you economic policies that benefit you. And the money that you get from that connection will make your political connection work.

That's the idea of lobbyists or the pharmaceutical companies spending money on lobbying. They send lobbyists to Washington...the farmers doing it with ethanol programs (actually not even the farmers...midland and then Cargill)...so that political economy cycle which we're seeing all the time, and then in this country, and of course around the world, it may be playing a very large role in the wall street

bailout. Or it might not have any role at all, and we're just paranoid.

So I personally think that there's a lot more politics involved with the economic bailout than maybe there was with the conspiracy around 9/11, but it's not obvious, that's the problem. I'm reading all of these confessional articles coming out right now from ex-bush administrators. I just read this thing about one of Bush's old speechwriters talking about how he had no clue that about the package he was presenting to the country.

So his idea was buy low, sell high. And everybody was like no, no Paulsen wants to buy high and sell low. So the president went out and made a speech, but he didn't know what he was talking about. Well, he did know what he was talking about, but it didn't match what was going on. So this kind of stuff will come out. And this is the good thing about a democracy (better than other places).

In the same issue...I was reading about the Russians, and the Chechnya war...(this is a little off topic but not that much off topic)...and if there was one really strange thing about how Putin got into power...Putin...no one had heard of this guy in 1999. And suddenly he's just a leader in this war against the terrorist Chechnyans who'd just blown up a whole bunch of apartment buildings. But that, in my mind, was a complete inside job. That was the KGB.

And they blew up their own citizens in order to switch the power over to the guy who was going to lead the war against the Chechnyans. He declares victory, suddenly he's popular, and he becomes president. Has anybody ever seen *Wag the Dog*? No, yes? I had to look and see. *Wag the Dog* is about a president who is embattled over some problem. I think in the movie he was having an affair with an intern, right? And he starts a war in another country, and the thing is that this movie, I believe, came out before the Monica Lewinski thing came out. And the Monica Lewinski thing came out, and then Clinton has the Kosovo Serbian bombing campaign. It's almost like the White House said, "Wow, that's a good movie, maybe I should have an affair with this intern, and then there's going to be a media uproar, and then I'll go attack Kosovo." It was just unbelievably Russian, right?

Or it's a pattern that just gets repeated over and over again, right? So that's the politics side of things. So Putin is now the most powerful man in Russia, obviously. And it came from this war of liberation and freedom to fight the Chechnyans, and the Chechnyans were like, "Hey, it wasn't us." They were essentially the scapegoats, the same way that the Vietnam War was turned up by what? There's some notion that FDR knew about Pearl Harbor happening...there's all kinds of stuff going on. Anyway, that's politics and this is economics. And they interact a lot. So that's why I think this is actually on topic.

That was a question. Other questions?

[Do prices tend to increase or decrease during a depression or a recession?]

That's a good question. What happens with demand in a recession?

[It goes down?]

Right. So...and let's just say...this is the economy (this is Q, right? All of the economy...). This is the demand before the recession, and then demand shifts in. This is a macro thing. I'm a micro economist. There's this IS/LM stuff and the velocity of money. But let's just try and be stupid about it for a second. The question is: do prices go up or down? If we have, essentially, a perfectly competitive supply in a market, then prices would tend to be level by definition, right? If we have an increasing supply curve, then prices will go down as the quantity of goods demanded falls as the demand curve shifts in. So prices are going to either stay the same or they could rise. Because remember, if you have an increasing returns to scale technology, you've got this kind of marginal cost curve.

Usually the prices will fall. I'm not going to sit there and make a large argument for the counterfactual. But for an individual firm, they might be able to sell as many units as they used to, so their cost per unit might go higher, right? This is a real problem with water, right? People use less water, and the fixed costs of water are so big that they actually have to raise the price per unit of water even though people are using less. That's an accounting problem. But in the macro sense, my general impression is that the prices are going to fall. Same thing, just assuming your perfectly elastic supply curve, which is not typical.

[Given that situation, wouldn't that cause the Y to shift in too because they would expect consumers to consume less, so the prices might rise...?]

Yeah, so this is the dynamics question, right? You're a company. If you're Starbucks, do you say, "Oh there's a depression outside. Well, whatever, a latte is still \$4.50." or do they say, "We better fire somebody because we're not going to have enough volume." Or "we're going to have the Go-Go value coffee special, which is only half a cup for 2/3 of the price." So that kind of adjustment in the market is what will be happening. And then we're talking about demand shifts, supply shifts, and expectations of a demand shift. The demand will shift, and that will be accurate or not, right? Because the Starbucks man might think, "Oh I think it will shift in like that—farther than anticipated, right?"

This might happen in the house market. They're like "Holy cow, demand is really shifting in." or maybe they overestimated. And this has to do with business cycles, right? So the idea that you have change in GDP, and basically business cycles are just like this. And what is this? Recession. Or, more importantly, this is a recession, right? Growth is negative. And then, wow, look, our economy is like...as a whole...if you think of this as being positive growth...it's decreasing at a decreasing rate, and then it starts increasing, and then it goes positive.

If you go from -5% to -3% GDP, you're actually doing better, right? The economy is getting better. And then you go to 0% or 1%. So this is why, in China, when their economy slowed down to 9 from 11%, all the way down to 7%, it was a huge disaster. 7% economic growth is awesome anywhere else in the world, but relative

to what the Chinese economy (or the people in the Chinese economy) were used to, that 7% was essentially a depression for them (or a recession).

[Doesn't that shift cause a change in inflation?]

Well inflation is...I'm a Milton Friedman fan...so this is actually just Real GDP. Real. That mean's adjusted for prices.

[And what does it look like if you don't adjust it for prices?]

It's usually accentuated. And it depends because the fall in prices reflects all kinds of stuff. Real economic activity will be going up and down. The money supply can have a big impact on that, right? And when the Fed put the interest rate down to 0%, what else can you do to pump up demand? And they have this thing called quantitative easing, which is just pumping lot's of money into the economy, so money is cheap, and so whatever you have it's like...oh I better spend it. Or, the alternative is, if I have \$10 today, and I have 0% inflation, what's it worth tomorrow? What's it worth tomorrow? \$10, right? What if I have 10% inflation? It's 10 divided by $1+i$. it's worth less. And it's worth less tomorrow, so maybe I should spend it today, right? So idea, sometimes, is that if inflation is happening, you should spend your money right now.

And in the worst cases of hyperinflation, Zimbabwe just went through several million percent inflation. People get paid with wages 2 or 3 times a day. They would go out, buy bread, go back to work. Because the prices were changing so fast.

[In a hyperinflation like that, don't you just go back to bartering?]

Yeah. Money's worth nothing. And I've been in places were money was the toilet paper. Where the toilet paper was more expensive than the actual money. So it's cheaper to use your money as toilet paper, ironically. But those watermarks are really tough.

So any other questions I have no idea how to answer right?

[So what do you then in a situation of hyperinflation?]

What do you do with hyperinflation? Traditionally the solution is to impose some kind of gold standard or currency board. Basically, throw away your money and start it again.

In Zimbabwe I don't know if they're trying actively or not. But in the most famous example, that I remember of an economist actually having a positive impact on this question was when Jeffrey Sachs was the advisor to the Bolivian government during the hyperinflation in the 1980s. And they had a problem, they had inflation. And I think they put together a currency board, so they linked the money to a firm currency like the dollar. And then the government couldn't inflate the currency anymore. And the people said, "Oh, I guess my money will be worth the same tomorrow as it is today. Maybe I can hold on to it."

And inflation fell from...I think it was a hundred plus percent per year down to more like 8% per year. And if you don't know it already, this is the micro of development economics. Inflation hurts who? The rich or the poor? You get a choice. Rich? Poor?

It hurts everybody, but it hurts the poor more. Because the rich can just put their money into dollars. Or they have real property. And the poor...whatever money they have is worth nothing. If you have nothing you lose nothing, that's right, but it depends also on like, if you're getting paid wages versus you're buying things. Are your wages rising faster than what you're buying? These are difficult questions for poverty.

[What about in terms of debt versus savings? People can save money that's worth nothing tomorrow, but they can get their debt lowered...]

Right, yeah, so debtors and creditors are different from rich and poor. Because if you're a creditor, and you're a rich person then you have those loans out there. You don't have it in your national currency. You have it in hard currencies. So then you're insulated.

I lived in Croatia for a while. You paid your rent in Deutsch Marks. You didn't pay your rent in the local currency. Deutsch Marks. Because they didn't trust the local currency. People salaries were set in Deutsch Marks, even though they had a local currency. So Americans are not used to this idea, because we have this thing called the dollar, and everybody likes dollars around the world. And the Australian dollar is not the same as the American dollar.

[And then some places, they'll trick you. They'll go out and say that the price is 10. And you pay 10 Turkish Liras, but they'll take 10 dollars or 10 Euros or 10 Lira.]

Oh yeah. If you put more money on the table, they will take it off the table. I met someone, and she's like, "Oh, yeah, I'm American; I go to Canada to pay American dollars." It's 1:1, right? I mean the Canadian dollar got stronger than the American dollar very briefly, but you're just throwing your money away. So, whatever, make people happy. Any other questions?

I didn't know that there was a handout that contained the word Hessian on it. And it had a lot of math? That has been struck from the record. Forget everything you ever saw. I don't even know what a Hessian is. It has something to do with the Prussians or something like that. I have no idea what this means...

Okay so on the blog: some people have failed repeatedly to follow my instructions. Do not send an attachment that is a word document. If your attachment is on the e-mail, it should be .txt (that means text) I asked for text, I didn't ask for a word document. I will send it write back to you. If it's after the deadline, you will get zero points if I don't get to it. And I'm not going to be monitoring my computer at like 11:59 on October 1st. So do not send a word document. Okay? And have a bottom line. I don't care how ridiculous it is. Bottom line: _____. You don't have that? I send

it right back. And that's all the vetting I am doing. So someone asked me, "Oh, will you read it and make sure it's good economics?" No. It's going to go on the web, and then everybody gets to criticize it. So if you're worried about your economics, talk to your roommates (if they know economics).

[So we can also copy it into the e-mail?]

Absolutely. I just want words. I don't want this word crap formatting. Due October 1st.

Homework 2 is going to be on all this producer stuff. It's due October 8th, which means that we have to get our act together to make another homework. It'll be similar problems, in a way, to these problems. But these ones were consumer, that'll be producer. It's due on the 8th. The midterm is on the 15th. So that material will be showing up on the midterm, okay? And because of the lag between grading and handing back, we're probably going to be handing out the answer key. So you guys will have time to check your answers. Or I'll do a tutorial on...if it's the 8th...I'll try to do a tutorial on the answer key so you could have a good idea.

I am writing the midterm. The midterm will look a little bit like the homework and a lot more like this crap I put on the board. So people that are worried about Hessians on the midterm, it's not going to happen. Any other outstanding questions before I get to variable cost, marginal cost, and all that stuff?

[Did you write the homework?]

No. It was very beautifully typed and formatted, which is my favorite. Typography language. Any other questions? I looked at it ahead of time to make sure that it was okay. Just stuff you should know.

So last lecture I screwed up on this discussion of the optimal point for a firm's production, in terms of where it was most profitable. And we're going to spend a lot of time today on this word, which means what?

[Profit]

Profit. So we're going to spend a lot of time on profit today, and this should help clarify what I made a mistake in. So I think the mistake was something along the lines of quantity, average variable cost, marginal cost. Or average cost. So we were looking at the average cost curve (and the average cost is the fixed cost plus the variable cost).

That's your accounting identity. This is just a stylized average cost curve. We use it to show that as the average fixed costs...and we basically assume that average variable cost is rising, average fixed cost is falling. If you combine, you get this kind of bowl shape. Does that derivation make sense? It's a stylized shape of this curve. Obviously, the actual shapes of these curves for an actual firm will be different. But we just want to start with the idea that the cost of the item is falling as you amortize these fixed costs across quantity. And then they're rising...although this part is

falling, this part is rising. Because it's just reflecting our usual assumption...rising marginal costs.

So the first thing I want you to know is...if we assume that this is the marginal cost curve, the relationship between the marginal cost curve and the average variable cost curve is something like this. You just take an arbitrary point, and we take the average of this MC one, Q one. MC one (that's the marginal cost there) the marginal cost here and halfway in between...and this average variable cost curve is going to be tracing that average. So the average variable cost at this point is going to be equal (just dividing that in half). So average variable cost is rising. Average variable cost is rising, variable cost is rising more slowly than marginal cost.

So how does that relate to this curve here? Now this is obviously the minimum of average cost. And this is what we often do (we economists in our stylized versions of the way that costs work). We have that going through there because marginal cost is rising. It's always above average variable cost. This is the most important point for you to concentrate on. Or to remember. That the marginal cost curve passes through the minimum of the average cost curve.

And what's going on at that point, is that...notice that the average costs are falling and then they're rising. Marginal cost is below average cost, so it's falling, it's falling. Remember marginal cost is the cost of each additional unit. When marginal cost per unit is above the average cost curve, then it's pulling those costs up. Think of...the marginal cost is pulling up...this is always continuing to exert an upward force on average variable cost. If this was the shape of the marginal cost curve, then the average variable cost curve will go like this and then it will level out also. No, it would slowly go tangent to here.

So these curves and the relations are very hard to get the first time you see them. Hopefully this is not the first time. If it is, you're just going to see them more and more. Keep in mind that the marginal cost...this is the cost of producing this unit here. The marginal cost of Q one and the average variable cost is that particular small cost plus all of the other small costs that were on the way. So that's just the average. If you have to put in the number, go ahead. This is four, this is zero, so this is two.

[You know the intersection up there? Can we see that on the bottom graph?]

Umm, good question. That point actually depends on the calculus because I think it's going to be the point where the increase in average variable cost is identical to the decrease in the average fixed costs.

[So it's not when those two cross?]

It is not when these two cross. This is not important, as far as that's concerned. In fact, that's not important, period. Neither is this.

[I don't understand why the average variable cost is rising, and not a straight line...]

Because in this particular example, marginal cost is rising. If marginal cost is flat...

Variable cost, marginal cost. That's marginal cost. What's variable cost? Same, right? And what's average variable cost? Same. So if marginal cost is rising, then they both start off with 0, but take this is an example. This is the marginal cost (let's say it starts at 5) the average variable cost of that point is not 5, that's the marginal cost. The average at 5 is rise over run...here's the way to look at it...

This is the area under the marginal cost curve, this is the total variable cost. Essentially, we want to push this area over there until we fill it in and get a flat line, and that would end up being the same volume, the same total variable cost, and that is how we would get this average variable cost curve. The average variable cost at this point, times the quantity, is also that volume. This is actually a useful way of seeing things.

But remember that average cost is taken across all your units, and marginal is just for the last unit. Marginal. On the margin. The last one.

Now, let's look at this and how it relates to question last time that I was getting right, and that I was saying wrong. The right part...

So let's use this bowl up here (average cost, marginal cost). And the question is where is it most profitable for that firm to produce? Well, let's say that this is price. Is this company a price taker or a price maker? Price taker right? Because as quantity changes...

This axis as MC, AC, and Price on it. So the price taker, this line represents...what's the other name for price on this line, in terms of profit maximization? Marginal revenue. Marginal Revenue=Marginal Cost where? Marginal Revenue=Marginal Cost at points A. They cross. That's a nice, easy one. So the firm is going to choose to produce Q1. Now that is not at the minimum point of the average cost curve. That's what I made a mistake on last time. Either I said it, I implied it, or I talked about it. It's not true. A profit maximizing firm will make a decision on how much to produce based on the relationship between marginal cost and marginal revenue.

Now what's clear is that this is an area between the minimal point and the actual decision. Average cost has risen, but that doesn't matter. What matters is the relationship between marginal cost and marginal revenue. At that point Q1, the marginal revenue is P, the marginal cost is P. To the right of that, producing more, let's say here. Let's say you produce this much here. You have a marginal cost of producing it as far larger than marginal revenue. That is making a loss. You do not want to do that as a firm. You do not produce that far. You stop at this point Q*.

[You know the curve for Q1, is that where the curve for average cost is the lowest?]

No it is not. Q1 is an arbitrary point with respect to average cost. Arbitrary.

[Why wouldn't it be more efficient to produce when the average cost is the lowest?]

Because the average cost reflects all the costs of all the units you have produced so far. Now remember there was this question of where...I think this is where it started...this is where it was getting confusing...we had this average cost curve, and we have a price line here. What's the profits at this point? Zero, right? Because average costs and price are equal. I mean its...total revenue minus total cost is equal to profit. I'm going to call that P times Q (I'm going to call that P_2) minus AC , Q_2 . And that's essentially the same number, so that's equal to zero. Now should I produce right here? That's where the average costs of all the units so far is minimized. So this is why I gave this example here. The profit here is zero because you're looking at areas in this thing. The area under the total revenue curve and the area under the average cost curve is the same. That's why it's zero profits. But when you're talking about...so you were making a profit...and now you have your marginal costs.

Given the marginal costs are increasing, the decision to produce will always be after. With one exception. It will always be at this point or to the right of this point. And what I mean by that is...in a perfectly competitive market place, where you have a lot of firms, they're going to compete away profits so that the price falls, and they're just making an economic profit of zero. This is perfect competition. And in the long run. I'm going to talk more about that.

In the long run, firms will keep entering the market. If the price is over here, if the price is higher, at this point here, is the firm making a profit or not? Yes, it is making a profit. At this point Q_2 , marginal revenue and marginal cost are equal, so that's the profit maximizing decision, but the price here, times the quantity, which is the box here, and the cost is taken off of the average cost curve. The cost is either going to be this cost here (so it's all the way over and all the way down, so it's a rectangle, under that box) or it's going to be the sum of all the marginal revenues under the marginal revenue curve. The thing that's obvious here is that the difference between this and this is greater than zero. So this entire box here is profits for the firm at that point. If there are profits, then another firm says, "OO, maybe I should enter the market."

So another firm enters the market, and another firm enters the market, and another firm enters the market price will fall, and another firm enters the market. As firms enter the market, price will fall because the supply curve is shifting out. As firms enter the market, the supply curve is shifting out, price is falling. And as prices fall, you can see that that profit is getting squeezed. And it will get squeezed all the way down to zero. If there's negative profits, the firms start to leave the industry. They go somewhere else. That's a discussion where long run profitability goes. Long run profits in a perfectly competitive market are what? Zero.

And the fact is, we're almost never in a negatively competitive market and we're almost never in the long run. We're stuck. It's interesting. Is that clearer? Are there more questions?

[So in your error last time, where you did not make the marginal cost curve go to the minimum of the average cost curve...]

I forgot to do that. I forgot to say at the time the firm was going to produce the difference between average cost and price was the greatest. They won't produce there. They're going to produce where marginal revenue and marginal cost are equal. I should be just shot for that because we say that all the time. I should have a tattoo. So this is a point that's interesting almost all the time. It's trivially interesting. It only really matters in this long run perfect competition context. When that point actually gets used, right? Until then, all we know is that the marginal cost curve passes through the minimum of average cost. It's not necessarily by construction, it makes sense from an economic decision perspective.

[So what would be the optimal Q then?]

Under MR2 or MR1? Where would it be?

[Where Marginal Revenue = Marginal Cost]

Yeah, that's always going to be the optimal point. And I'll show you the math in a second. It's kind of cool when you see it explained more. Yeah.

[So it doesn't really matter with the average cost. All we have to observe is that the average cost is falling and rising...the inflection point?]

Yeah that's the inflection point. So the inflection point shows up because we know the average cost curve is always falling. And we assume that average variable cost is always rising. Because of the marginal cost curve. So the combination of falling and rising is that you're going to have an inflection point somewhere, right? It turns out to be an accounting identity that the marginal cost curve will pass through the minimum. And that's helpful in terms of doing analysis. Because if I say, "where's the equilibrium point in a long run competitive market?" You'll say, "there."

You don't even have to do any math, calculus nothing. It's just right there. But at that point you have to say, marginal cost = marginal revenue. What about the other optimal point? Marginal cost = marginal revenue. But the marginal revenue might be moving around. The marginal cost curve is static in this. But the marginal revenue is moving around because of that price entry because that's falling and rising.

[So where MR2 and AC intersect, that's no...]

No, because the production decision with MR2 is what Q?

What Q would the company produce given MR2?

Marginal revenue = marginal cost, but where? Q2.

That point here is like whatever. It's out there. This point determines this quantity. The fact that this point and that point exist doesn't have any impact on the decision of the firm.

[But if we weren't in a profit maximizing society or a profit-maximizing firm, and we just wanted to produce as much output as possible instead of breaking even, then we would produce at that point there. So if we were socialist...that's where we would...]

That's the theory, in fact, of regulated utilities. The theory is that they'll be breaking even. It turns out that it's very hard to manage that. Like if you're only breaking even, then do you care about cost increasing? Because you could just raise your price. There's all kinds of interesting dynamics. But from a social welfare perspective, and I'll get to that in a second about prices.

Any other stuff about this VC/AC stuff?

So let me segue into more on profits. I'm going to give you a couple of examples. I'm going to four here, and then I'll go back to three. I want to give this example because it'll make things more concrete with profit decision. So profit, we'll define as total revenue minus total cost. Now if we have a perfectly competitive firm...when we have a perfectly competitive firm, do we have an impact on the price and the market. Price is exogenous, right?

Price times Q_i , the amount of quantity chosen, minus a function of $C-Q_i$, is still the profit equation. If we want to find maximum profit with respect to the amount of Q_i that we choose, we take the derivative. We find P minus C prime. We take a derivative. This is the derivative. We set it equal to zero. And then we solve. We find that P is equal to C . or marginal revenue is equal to marginal cost (C prime).

So this should be fairly straightforward. All we're doing is we're setting up pretty straightforward stuff. Price times quantity, how much revenue do I have, cost, and the assumption you make about cost is C prime is what? Is marginal cost rising or falling? Rising. We're just going to assume that. And that's how...we assume that it's greater than zero. All the math geeks out there...it's rising... C is greater than zero. C prime is greater than equal to zero. C double prime is also greater than or equal to zero. It's increasing at an increasing rate. So that's just true. That's a true assumption. We're assuming that. Later on I'll get to the examples of falling marginal costs. Just because that's a significant industry. Now, next to that, let's look at the (this perfectly competitive firm)...

A monopolist. Does a monopolist have an impact on the prices? Yes, good. So profit is equal to total revenue minus total cost. I'm just going to put an m here for monopolist. P , which is a function of Q_m , $PQ_m - CQ_m$. What have I changed here on that one compared to perfectly competitive?

Price is a function of quantity, right? This price is no longer exogenous, the price is endogenous, right? Price is determined inside of the equation. So the profit making firm is going to set...it's going to take a derivative... Q_m so we get $P^*Q + P - C^*Q$. So this is the additional component that get's added to this.

I'll get to an example that will make this really clear, but this is what's going on with the basic math. So we set that equal to zero. And now we've got... P^*Q plus P equals

C prime.

[How did you get P for the...]

This thing here? That's the chain rule.

[Is it the chain rule or the product rule]

The Product rule. Here's the thing. So if the marginal cost here is $\frac{1}{2}$, and over here, what's price going to be? Price is $\frac{1}{2}$, right? Marginal cost is $\frac{1}{2}$. Just for example. Then price is equal to marginal cost, right? Price is falling. So here, I'd say that's $\frac{1}{2}$. Price is going to be (this is a positive number). Is price is going to be higher or lower? Lower, right?

The firm, by producing in the market, is actually lowering the price. And I'm going to give you a graphic example so you could see it. But every time the firm a firm puts another unit in the market, the price is falling. That's because the firm is affecting price, right? By meeting demand the price is dropping. And let's look at an example of that to make this abundantly clear.

Over here, let's just say, for both of these firms, $C(Q)=Q$ squared. C prime is equal to what? $2Q$. Just taking a derivative right?

So that looks like this, this looks like that.

Cost is increasing at an increasing rate, and marginal cost is just linear. And this is just an example. Marginal cost can be curved, as long as it's going up. That's all I care about. So, with our perfectly competitive firm here, let's say that we're going to have price, and we're going to have marginal cost, and they're going to pass each other. But we know that...let's just make this $P=1$. So price is equal to one. It's a price taker, price can be anywhere I want. Price can be one, two, four, five, doesn't matter. $\frac{1}{2}$. Price is equal to one, what's the quantity produced? $1=2Q$. $Q=1/2$. Right? That is it.

Total revenue equals what? P times Q.

Total cost equals what? What's the cost function of this firm? Q squared.

So profit of the firm is $\frac{1}{4}$. Is that equal to area A or area B? Area A. The area above the marginal cost curve and below the price curve. What's that also called in our econ one language? Producer surplus, right?

And I'm doing this because I want to compare this outcome. I want to compare this outcome to the situation facing a monopoly. And remember that the vast majority of the world is an oligopoly. It's in between these two, right? But these extreme cases are meant to teach you what's going on.

Oh, to give you intuition: so the thing that drove me crazy when I went to grad school was when the professor said, "Oh, use your intuition."

Intuition in economics is not the stuff you were born with. Like, I like sweet food, or I want to sleep on Saturday mornings. Intuition is what you learn in economics. So I'm trying to teach you the intuition. So this example is about that.

So we have a monopolist. We have a demand function, which depends on the quantity of the market. Now there's different ways of thinking about this. The easiest way to think about this is that this is one firm out of many, many, many firms. This firm is only one firm. I'm going to change this Q and make it only $1/2 Q$ for the market, or the monopoly. I'm going to change the scale, sorry.

Q_m , P , 1 , and 1 .

[When you're talking about I , do you mean that graph there?]

This is I , this is M .

[Is that the graph for the monopolist?]

No, this is all perfectly competitive. Everybody got that? One column, perfectly competitive. Next column, monopolist. I'm trying to compare them side by side.

So the total revenue of the firm, the monopolists, is this equation here. And I've got a functional form here. That makes life easy.

Let's rewrite the total revenue equation. P is a function of Q . That's the price times Q_m . Right? I'm assuming, I'm asserting that this is the demand curve. That was general now, and this is a specific example. So if I take a derivative of this, I get that. What is that? You can think about it.

This is the total revenue function. What is this? Marginal revenue function. Ok?

How do I draw that? This is $1-2m$, this is $1-m$. How convenient. This is demand, this is marginal revenue. What's the intersect down here?

When price is 0, what's quantity, $1/2$. Right on. Just as a matter of technique, if you ever see, and you will, in this class, a demand curve, the marginal revenue curve is twice as steep. Pure math. If it's linear, linear, linear. Let's use the same cost curve (same marginal cost curve). Where's that firm going to produce in terms of things that are on that graph there?

[Where MR intersects with MC ?]

Yes, where marginal revenue and marginal cost are the same. Marginal cost equals marginal revenue.

So they're going to produce this much quantity. What's the price at that quantity?

It's on the demand curve. You just go up from this intersection to the demand curve and you plug it in. What is the number here? Q .

Did we figure this out yet? What the quantity is yet? Okay hold on.

So let's do that. This is marginal revenue, right? And the marginal cost curve...did we specify the cost curve? Here. Here's the marginal cost curve, can somebody solve for that and tell me what Q_m is going to be? $\frac{1}{4}$.

Price is therefore going to be what? $\frac{3}{4}$. This demand curve is $1 - Q_m$. $1 - Q_m$ is $\frac{1}{4}$ $1 - \frac{1}{4} = \frac{3}{4}$.

Now what I want you to take away from this are two things:

One: The monopolists will not choose to produce where the marginal cost curve crosses the demand function. They will produce less. Over here, the perfect competitor will choose to produce where marginal cost crosses the demand function. The fact that this is equal to one and this is equal to $\frac{3}{4}$ is irrelevant. It's a simple mathematical example. But the perfect competitor would produce as long as marginal revenue is greater than marginal cost. Profit maximizing firm (which is still the same as a perfect competitor) will produce where marginal revenue equals marginal cost.

It's the same decision, but the curve that matters for a perfect competitor is the demand curve, which is basically that price, The curve that matters for a monopolist is the marginal revenue curve. That is a big, big difference, right? Marginal revenue. And this is the thing. We'll get to price discrimination. The monopolist can charge, can reduce quantity to here and charge this price. Just choke back supply and produce it so that it produces so the price up here, or produce so the price is here. Or it can produce so the price is here. The monopolist gets to choose how much to produce. The monopolist will choose to produce where the profit is maximized. Which is where marginal revenue and marginal cost are equal. But the reason that it's not more profitable to produce so the price is higher is why?

What's the intuition. So the surplus here, I get this area here as profits if I choose to produce here. If I lower my price a little bit, everybody pays the same price. This is very important. Price discrimination [is] different. We'll talk about this a little bit more about that. Cell phones, cable bills, DVD renting, car insurance, razor blades, all those things are ideas of price discrimination. This is a much more simple example. Everybody pays the same price. If I lower my price a little bit, says the monopolist. Oo look, that's bad because I lose some revenue up here. But it's good because I get this whole other bit here.

You lower the price, you sell more quantity. You lower the price, you sell more quantity. You lower the price, you sell more quantity. And after a while, you can keep lowering the price, and sell more quantity, but the effect will reverse. This is the key point. If you go down here "Oh look I'm selling a lot more!" but the area of this rectangle here is maximized at the optimal point. The area is maximized. The profits are maximized. So the graphical way of looking at it is area. The calculus way of looking at it is, every time I lower my price a little bit my quantity increases. How does that affect my total revenue versus my total cost?

And I'll draw a picture of that in a second. And the algebra and the area are showing the exact same process. If I lower my price I can sell more. If I lower too far, I'm selling more, but now I'm making less of a profit. And that's completely driven by the idea that marginal cost is increasing. Just for example, you've got a monopolist they're facing a downward sloping demand curve. Marginal revenue curve is here. And the marginal cost for this firm is zero. How much does the firm produce? At what point, what quantity? What does the monopolist choose to do when marginal cost is zero?

MR = MC. Where does MR=MC?

[Zero]

Marginal cost is zero. Where does marginal revenue equal zero? On the axis. What part of the axis? I got one and two. Which point? One. Marginal revenue curve crosses the marginal cost curve right here. Bang, there's my price. It happens to be $\frac{1}{2}$ because of this 1 minus 2 construction. So this for the monopolist is the optimal point of production. And all of this is profit to the monopolist.

Consumer surplus is that area A above that line. Typical scenario. What's happening with so-called deadweight loss? Social cost? Are they greater than zero or equal to zero in this construction? Deadweight loss is equal to zero. It's equal to area C, right?

The marginal cost is zero, I could produce all the way out here to point 2 couldn't I? Cost is zero, so that's fine. And I'm lowering the price, and lowering the price, and lowering the price, says the monopolist. My profits are falling but social welfare is increasing until, when you get down to price zero, A+B+C is equal to profits? Yes or no? No. Is that the consumer surplus? Yes. Is that the social surplus? Yes.

Consumer surplus + producer surplus = social surplus.

When you're a regulator looking at this situation, you're like, "Hey there's a monopolist here. What we want to do is push their output from one to two, so that they produce more so that society is better off." Unfortunately this monopolist doesn't want that. Monopolist pushes back, right? I want profit. So that's that tension between one and two. And it's also called the tension between bargaining and efficiency in some circles.

Efficiency is producing at point two. The bargaining result or monopoly or strategic result is produced at point 1.

[What do those two curves represent?]

This is the demand curve and this is the marginal revenue curve. The marginal cost curve is just zero. It's just flat along the axis. That's just for the sake of an example—simplicity. Any other questions?

The firm is dealing with this situation right here, lot's of little messy areas here.

They're producing $Q_m = 1/4$, right? What's profits for this firm?

Profit for the monopolist is equal to P times Q , $1/4$. And P at $1/4$ is equal to what? $3/4$ minus total cost.

Total cost function is Q squared. Total cost is Q squared, $3/16$ minus $1/16 = 1/8$. Now $1/4$ versus $1/8$. Completely irrelevant. I'm using numeric examples, so you guys can understand what's going on.

[Does that mean that it can happen that a competitive firm makes more profit?]

No that's exactly what I'm *not* saying. I am not saying that a monopoly will make less money than a firm in a perfectly competitive market. And here's the way to understand that. This is an example. It's a simplification. If I wanted to do this for a monopoly, and let's just say that there's 100 firms in the market. And each of those firms are making a profit at $1/4$. And they have this demand function here.

Then this firm would replace 100 firms. Right? And then will choose against aggregate demand. How much to produce. And this could be (instead of $1/8$) it could be...125. Right? Or 12.5 if I keep the scales...it doesn't matter.

The monopolist is facing the entire market. The perfect competitor is facing a tiny segment of the market. So the number $1/8$ and number $1/4$: the relationship between those two numbers is completely irrelevant. What matters is that the $1/8$ is a decision facing this demand curve. Notice that I have price is equal to 1. I just set that demand equal to 1. So I could have set that equal to 4 or 5; it doesn't matter. I just set these up.

So the lesson of this example is that the monopolist makes a decision of how much to produce based on marginal revenue = marginal cost. But the marginal revenue curve for the firm is a downward sloping curve. The marginal revenue curve for the monopolists is downward sloping. The marginal revenue curve for the perfect competitive firm is a flat line. It's that price. Does that make sense?

And that's the decision they make. Now let me draw this a different way. That would be algebra. Let's just do a little graph showing profits. We're still doing marginal revenue and marginal cost.

Just temporarily here, let me draw in...

Put on a note on the side of this. Total revenue for this firm is this line here. It's just p times q . It's just linear, right? Cost function is like this. Total costs. This is a reminder what happened in the last lecture. Is a firm going to produce at point A or point B? Point A, right?

Total revenue is equal to total cost. Profit is equal to zero. This is where marginal revenue (the line, the slope of the line) is equal to marginal cost. Sorry. Where marginal cost is equal to marginal revenue. The difference here is the greatest, and that turns out to be $Q = 1/2$ here. Now for the monopoly, just to keep this idea complete,

it's going to be something like this, right? Because total revenue is going to fall off as you produce more, because you're dropping the price. And you want to get to the point where this line and this line are parallel. Again, where marginal revenue and marginal cost are equal. So there's less quantity in the marketplace. Take any firm that's perfectly competitive and make them into a monopolist given the same demand function. Which is a very big caveat, which is kind of crazy. But anyway, they will produce less. Monopolists always produce less because it helps them keep the price higher.

So that's just an elaboration of what's going on with the shapes and curves and the parallels and stuff like that. Let me quickly finish this up and look at the profit function for this firm. The perfectly competitive firm, at a quantity of zero, the profit of the firm is zero, right? At a quantity of $\frac{1}{2}$, the profit for the firm is how much? $\frac{1}{4}$. Right? At a quantity of one, the profit of the firm is what?

Because I've got one times one, price times quantity minus one squared is equal to zero, right?

So at quantity of 1, the profit is again zero. You get this kind of hump shape, or parabola. Profit maximization? At the top. Because this is profit. The highest profit is right there. $\frac{1}{2}$.

For a monopoly, the situation is different, or the same. But we have one half, and one. What's the profit for the monopoly at 1? Quantity is equal to 1, what is the price we'll get? Zero, good. Revenue is zero, costs are 1 squared, one. Zero minus one is minus one. You're down here. That's not good. Minus one. We've got zero...

At $\frac{1}{2}$, the firm has a price of...the monopolists. $1 - \frac{1}{2}$...the price is $\frac{1}{2}$. $(\frac{1}{2}, \frac{1}{2})$, - $(\frac{1}{2})$ squared. $\frac{1}{4}$ minus $\frac{1}{4}$, that's zero. Now we know that the profit maximizing quantity is $\frac{1}{4}$ and the profit there is $\frac{1}{8}$. So the monopolists again have a hump shaped profit function, but the quantities are pushed over, right? The profit maximizing quantity is again at the top, which of course is drawn to scale (that's $\frac{1}{8}$). That's the top, profit maximizing quantity is $\frac{1}{4}$. At $\frac{1}{2}$, profit is zero, right? If you think that this is a perfectly competitive firm then they become a monopolist, they're going to choke back quantity supplied, make more money selling less goods.

We're out of time for today. See you guys on Tuesday. Your homework should come back on Thursday.

Transcribed and checked for accuracy by Brynna Bunnag