

[SQUEAKING] [RUSTLING] [CLICKING]

**JONATHAN
GRUBER:**

OK, so let's continue. So this is actually, in some sense, a key breaking point in the course. Which is, in some sense what we've done so far is give you a set of tools to understand how to think about how consumers and producers make decisions, and then to understand how you compare positive and normative implications of economics.

What we're going to do for the rest of the class, for the rest of the semester, is we're going to start to talk about how you apply those tools to more realistic situations. Let me answer your very first question, what you learn today is not on the midterm, OK? So that's the question that's all on your mind because it is. So the midterm tomorrow night will cover everything through what we covered through last week, but what we learn today will not be in the midterm.

But don't leave because it will be on the final and it is interesting. So what we're going to do today is talk about taking the tools we developed so far in this class and applying to more realistic situations. And the more realist situation we're going to start with is the case of monopoly. And we don't talk about monopoly profit maximization.

Now so far on the producer side we've been discussing one extreme of how the market's organized, which is perfect competition. And perfect competition is a wonderful sort of theoretical benchmark but never actually exists in reality. No market is perfectly competitive.

The other extreme is not widely applicable but still does exist in reality, which is monopoly, OK? Monopoly is a situation where a market only has one firm in it. So a market with one firm is a monopoly market, OK? So that's basically a case where you have only one firm providing the good, OK?

Now in reality, most markets fall between perfect competition, which never truly exists, and monopoly, which rarely exists. Most markets are in between, we call them oligopolies. That's markets with several firms but not perfectly competing.

And we'll get to that.

But that's actually one of the harder things we'll cover, so we're going to start with this other extreme of monopoly which gives us a lot of the insights we need for oligopoly but in a much simpler case. Now, the key thing with monopoly, the key difference from what we've done so far is that now firms are going to be price makers, not price takers. That's going to be the key change from the perfectly competitive situation.

The perfectly competitive situation, from any given firm's perspective the price is something given them by the great market. OK, we talked with our two diagrams side by side about how the market gives the price. But we sort of-- from any given firm's perspective they were price taker. They couldn't affect the price.

Monopolists however, when you're the only firm you get to set the price. So monopolists are going to be price makers, not price takers. And that's going to change the dynamics of everything we do, and that'll be our focus today, OK? So that's going to be the big change, we'll go from competitive markets to monopoly markets.

Now, for the first 2/3 or 3/4 of the lecture we're going to make one other assumption. We are going to assume there is one price in this market, that is no price discrimination. This monopolist sets the price, but he sets one price for everybody. So if a monopolist is selling a good, they sell that at one price to everybody buys the good.

Now once again, this is not super realistic, monopolists often have different prices for goods. But it's a very important, helpful extreme. And you've got to remember that we're imposing this constraint because it's going to drive the intuition I'm going to come to next, OK?

So you're a firm selling a good at one price. You offer it up, anybody can buy it at that price, OK? Now, what we're going to do-- if you remember, a mon-- the fundamental part of producer that holds is the goal of monopolists is to maximize his profits, OK, which is revenues minus costs. And as we showed before, profits are maximized when marginal revenue equals marginal cost. That's the profit maximization point.

Now, nothing on the cost side is going to change. So monopolish monopolist, the way we get cost curves doesn't change. That's all about-- remember, because that just comes the technology production and that comes from input prices. So nothing on the cost side is going to change. All that hard and somewhat boring work we did deriving cost functions and stuff, that all is-- that's done.

The only place monopoly gets exciting is on the margin revenue side, because before we said marginal revenue was just price for a price taker. But that's no longer true. Marginal revenue is no longer just price. Now marginal revenue's going to be more interesting.

So the monopoly difference, if you will, or the imperfect competition difference, doesn't come at all from the cost side. That side is done, doesn't matter what kind of market you're looking at, OK? All the interesting action here is on the revenue side as we think about monopoly and oligopoly markets, OK?

So to think about that, let's go to figure 11-1. Think about-- let's start by think about a competitive firm. This is a diagram I could have shown earlier. It just sort of is a way to think about a competitive firm. Think about a competitive firm's profits.

So imagine that this firm-- to make life easy let's imagine that we have a firm with marginal cost of 0, OK? So you've got demand curve, and so therefore any money you make is profit. And we're in the short run, OK? So there's profit in the short run, even for this perfectly competitive firm.

But a perfectly competitive firm faces a horizontal demand curve. So if they sell q units, OK, they make profits of area a , which is simply q times P_1 , little q times P_1 . If they sell $q + 1$ units, they make an extra profit rectangle of B .

So literally, the marginal-- the extra profit they make is just the amount P . It's 1 times P_1 . The horizontal distance from q to $q + 1$ is 1, the vertical distance is P_1 .

So the marginal profit is just the price, OK? Marginal revenue, I'm sorry, it's just the price. Yeah?

AUDIENCE: [INAUDIBLE] competitive [INAUDIBLE].

JONATHAN
GRUBER:

Once it's in the short run there can be, right? In the short run there can be profit in a competitive market. In the long run there's no profit, OK?

So basically, their marginal revenue, what they make-- that next unit they make is the price, OK? Now let's think about a monopoly firm. A monopoly firm does not face a perfectly elastic demand curve because a monopoly firm's demand curve is the whole market. Notice little q has become big Q on the x-axis.

The monopolist no longer faces only their perfectly elastic firm demand. They face a market demand, which can be any degree of elasticity but typically is somewhat elastic. It's downward sloping.

Now let's say you're a monopolist and you're selling big Q units at a price P_1 . Your profits are C plus A . Once again, same marginal cost of 0 to make this easy, or C plus A .

Now let's say you want to sell one more unit. Well, what's different? What's different is now you're facing a downward sloping demand curve.

So if you want to sell one more unit you have to lower the price. That's the difference. If you want to sell another unit, you can only do so by lowering the price. And you're a price maker, so you have the right to do that.

So if you want to sell another unit, two things are going to happen. A, you are going to sell a second unit and make money on that unit. That's the area B .

But b-- I should say one and two. One, you sell the second unit. That's the area B .

Two, you will lose money all the other units you sold because now you have to lower the price. Because remember, there's only one price, OK?

So basically, you used to make A plus C . Now you make A plus B . You've added B , but you've lost C .

So what is the marginal revenue? The marginal revenue for a monopolist is now the area B minus the area C . Or P_2 , which is area B -- 1 times P_2 minus P_2 minus P_1 minus P_2 times Q_0 , the original quantity. OK?

This is the area C , but this is the area B . The original quantity times the change in

price. So your marginal revenue is not this simple just priced more and more. Now it's this more complicated term, OK?

More generally, marginal revenue can be defined as-- the marginal revenue is defined as-- marginal revenue is defined as $P + \Delta P \Delta Q \text{ times } Q$. That's marginal revenue. The first term is positive, that's the money you make on the next unit.

The second term is negative because, by definition, the demand curve's downward sloping. There's no given goods anymore in this class. Demand may be on a test but not in reality. The demand curve's downward sloping, OK?

So this term is negative. Now once again, I'm writing delta but really it's derivative. So this is all increment-- this is all-- this is sort of epsilon changes. This is Q_0 , OK? This is sort of epsilon changes.

But the bottom line is, for an epsilon change in price you get-- for an epsilon change in quantity you get the price on the unit you sell minus the money you lost. And then you too can no longer sell, OK? This is the key intuition of monopoly math. The k-- yeah?

AUDIENCE: What's that equation equal to? That [INAUDIBLE]

JONATHAN GRUBER: This is your marginal revenue. I just did it graphically. That's your marginal revenue. You just see that from the graph, OK, and I just rewrote it here, OK?

So basic-- or for those of you into calculus, if you just differentiate, just-- if those of you who have your calculus, you could just write, you know, dR/dQ , d revenue dQ, OK, what do you get? You get $P + dP/dQ \text{ times } Q$. That's just the derivative of revenue with respect to quantity, OK?

So let's think intuitively about what's going on here because this is very, very important. What's going on here is to sell another unit you have to lower your price. You're working your way down your demand curve.

And therefore, it offsets the benefit you get from selling another unit, OK? I like to call this the poisoning effect. I mean, it's not original to me but it's a term that I've heard use that I like, the poisoning effect. The idea is that to sell another unit, I have

to poison myself a little bit by lowering the price on all the previous units I sold.

If I want to go out in the market and force consumers to buy one more unit, I've got to lower the price on all the units which offsets money I used to make. So that's why we call it a sort of poisoning effect. Now, why doesn't a competitive firm face this issue? Why are we just bringing this up now?

Why does a monopoly firm face a poisoning effect and a competitive firm doesn't? Or alternatively, another way to ask the question is, in what situation would a monopoly firm not face a poisoning effect? Yeah?

AUDIENCE: Actually, in a [INAUDIBLE] in a competitive firm [INAUDIBLE]

JONATHAN GRUBER: Right. They're not-- that's [INAUDIBLE] right. The competitive firm's the price taker. But in particular, even though the price taker, why when they sell more quantity is there no poisoning effect? Yeah?

AUDIENCE: Demand is perfectly inelastic?

JONATHAN GRUBER: Demand it's is perfectly elastic. The firm faced a perfectly elast-- so likewise, a monopolist facing a perfectly elastic demand would also have no poisoning effect. Think of it this way, what is dP/dQ with perfectly elastic demand? Zero. The price doesn't change, you sell more.

So the reason the perfectly competitive firm face no poisoning effect is because it's facing a-- it doesn't, the price doesn't have to change to sell more units, OK? But a monopolist faces a poisoning effect because it's got a downward sloping demand curve. OK?

So we can actually see this-- so what we want to do in figure 11-3 is we graph the monopolist's marginal revenue curve. So let's actually work out the math here. Let's imagine there's a demand curve. Let's imagine that I've got a demand curve-- and I'm just making this up-- demands of the form A equals 24 minus p , OK? Let's just say that's the demand curve, OK?

Now the first step is to flip the way we express this and write this-- write price as a function of quantity because now the monopolist is choosing his price. So we can write that p equals 24 minus Q , OK? Just inverting it, writing price as a function of

quantity. So in this case revenues, which are equal to p times Q , are equal to $24Q$ minus Q squared. I just multiply through by Q .

So marginal revenues differentiating are just 24 minus $2Q$, OK? So once again, this is a new sort of mathematical trick you'll have to get used to. Flip the demand curve, so you express price as a function of quantity. Multiply through by Q and then differentiate, and you get that marginal revenue is 24 minus $2Q$.

So you can see that in figure 11-3, the marginal revenue curve is the demand curve shifted in, OK? Now in fact, this nice relationship will not always hold. This sort of picture of a marginal revenue curve being the demand curve shift [INAUDIBLE] will not always hold. It only holds for certain functional forms. Mostly we'll use functional forms for where it holds.

The main lesson is the marginal revenue curve has to be at or below the demand curve. That's the proof, OK? Whether it has this nice sort of shifted in relationship, that depends very much on functional form. But what is absolutely true is the marginal revenue curve is always everywhere at or below the demand curve.

Why? Because the demand curve-- because by selling a next unit you're going to make less through this poisoning effect. So the marginal revenue curve is always below the demand curve, all right? Questions about that?

OK, so now let's go on and let's talk about the critical relationship which I just developed-- intuitive, let's do it mathematically-- between marginal revenue and the elasticity of demand. OK, so take this-- we've got our marginal revenue expression, marginal revenue equals p plus $\Delta p \Delta Q$ times Q , OK? Now take that expression and multiply and divide by p .

So I'm just going to take this expression, I'm going to multiply and divide by p , OK? Then I'm going to get p plus Δp over p times ΔQ over Q times Q over p -- oh, p plus p . I'm sorry, no, I did this wrong. My bad, don't write that down. I've got to look more at my notes.

I'm going to write it as-- I'm going to multiply and divide by p . p plus p times, yeah, $\Delta p \Delta Q$ times Q over p . I skipped a step. So I just multiplied and divided by p , multiplied and divided by p . p plus p times ΔQ , Δp over ΔQ times Q over

p, OK?

Now if you look at this expression, Δp over ΔQ times Q over p , that is the inverse of the elasticity of demand. So you can rewrite this as p plus p times 1 over the elasticity of demand. Or rewriting one more time, that marginal revenue equals p times 1 plus 1 over the elasticity of demand. Marginal revenue equals p times 1 plus 1 over the elasticity of demand.

So think about this for a second. This gets the intuition we just talked about. If e is-- if the elasticity is negative infinite-- is negative infinity-- OK I had it wrong with 0 . It's the elasticity of demand is negative infinity then you've a competitive market. Perfectly competitive market is elasticity of demand negative infinity so you get a competitive market, OK?

As the elasticity of demand-- but if the elasticity of demand is 0 , if the elasticity of-- if the elasticity of demand goes like-- the elasticity of demand is negative 1 . Let's do that case. So negative infinity is perfectly competitive, OK? What about negative 1 ? What's special about the elasticity of demand of negative 1 in this case?

What's the marginal revenue? 0 . That's the case going back to figure 11-2 where B and C exactly cancel out.

So you probably thought about this when you looked at this graph. You probably quickly asked yourself, well, should the monopolist try to sell more or not? Well the answer is, the elasticity of demand is minus 1 , they're indifferent.

So this is sort of the important insight. With an elastic demand of minus 1 , the monopolist is indifferent about selling another unit because what they gain from selling the unit they lose on the previous units. If the elasticity of demand is greater than minus 1 absolute value, then they're going to lose money by selling additional units. If the elasticity of demand is less than 1 , then they're going to make money by selling additional units.

But let's-- I'm skipping ahead. Let's go on and talk about profit maximization, OK? So let's go on and take the next step which is the monopoly profit maximization.

Imagine a monopolist's cost function curve is of the form 12 plus q squared. Let's take the same monopolist and write down cost function of 12 plus q squared, OK?

So with this cost function, marginal cost equals $2q$. That's marginal cost with this cost function, OK?

So what's the profit maximization rule? It's that marginal revenue equals marginal cost. Well marginal revenue, we wrote down here, is $24 - 2Q$, so it's where $24 - 2Q$ equals marginal-- I should-- equals marginal cost.

Now with monopolists here's the trick, little q and big Q are the same. So I wrote a little q here, but if you're the only firm in the market little q and big Q are the same, right? There's only one firm in the market.

So $24 - 2Q$ equals-- it's a big Q now-- equals $2Q$. So the optimization point is where $24 = 4Q$ or $Q^* = 6$. That's the optimal-- that's the profit maximizing sale on quantity for the monopolist is where $24 - 2Q$, where marginal revenue equals marginal cost.

We derive marginal revenue, OK? Marginal cost we know how to derive from our cost function. We set them equal and we get the optimizing quantity, OK? And you can see this in figure 11-4.

Figure 11-4 shows what's going on here. So I've drawn all the va-- I've drawn all the various cost curves for this cost function, OK? I've drawn all the various costs first for this cost function. You can see the marginal cost curve and then you can see it intersects the marginal revenue curve at a quantity of 6. Intersects the marginal revenue curve at a quantity of 6, OK?

What is the price? Someone raise their hand and tell me, tell me why. The quantity 6, what's-- what price has the monopolist set? Yeah?

AUDIENCE: 18.

JONATHAN GRUBER: 18. Why-- you're supposed to get that wrong. You didn't-- you didn't, you didn't follow my instructions, you didn't get it wrong. You got it right, I'm just joking.

How did you know it was 18 and not 12? Usually people guess 12 because that's the point where the curves intersect. Why is it 18?

AUDIENCE: You can go up to the demand curve because that's what people are willin--

JONATHAN

GRUBER:

Because even the monopolist, as powerful as he is, has to respect demand. So the monopolist if they're going to sell 6 units, they have to choose a price such that people want to buy 6 units. So your intuition, which is my fault-- I've always said, look where the curves intersect, do a quantity and a price-- your quick intuition, which was to look and say the price was 12, which was the wrong answer I usually get, OK, is wrong because you need to actually respect the demand curve.

So a monopolist solves for the optimal quantity, but then to get the optimal price he has to plug this back into the demand curve. Well, what's demand? Demand is $24 - p$. So-- I'm sorry, it's $p = 24 - Q$, that's our demand.

So if Q^* is 6, then price is $24 - 6$, or 18. P^* is 18, and that is what you will get wrong when you do this. If you're going to get anything wrong in monopoly problems this is what you're going to get wrong, OK, which is remembering you can't just-- at the end you have to do an extra step here.

To get the price you have to solve for quantity, but then respect the demand curve to get the price. There's a question somewhere. OK, yeah, question?

AUDIENCE:

[INAUDIBLE] of the intersection of the [INAUDIBLE]

JONATHAN

GRUBER:

It's pretty much-- yeah, it's pretty much meaningless. So that intersection used to pin down the quantity, but price has to come from the demand curve because you have to respect-- you can't sell something consumers don't want to buy, OK? So you've got to respect that demand curve.

And in fact, you can show yourself-- so basically-- OK, so basically that's the profit maximization except this stupid goddamn shutdown rule still holds. In the short run we still have to respect to shut down rule, so you still have to check, is price less than average variable cost? Now once again, in this function OK, in this f -- you have to check with the price. So even if profits are negative you're still going to have to check if price is greater than average variable costs.

Now here at 6 units, the average variable cost is 6. You see-- we could see-- you see the dashed line. If we sell 6 units, the average variable cost is 6.

So clearly price is greater than the average variable cost. You wouldn't shut down,

you're making positive profits, in fact. You're making profits of 60, OK, so you wouldn't shut down. But you always do have to check the shut down rule, OK?

So that's how you do a monopoly problem, OK? Just to go back, how you do a monopoly problem, you'll be given a cost function-- you know what to do those in your sleep-- and a demand function. The demand function gets turned into a marginal revenue function simply through these couple of steps.

So the demand function gives you a marginal revenue function. If you have marginal revenue and you have marginal cost, then you know how to solve for optimal quantity. If you have optimal quantity and you respect the demand curve, you know how to solve for price.

Once you have a price, OK, and an average cost curve you can both check the shutdown rule and compute profits. Profits are simply the price you get minus average costs. So we can compute the profit and check the shutdown rule, OK?

So the only thing we did here that's new is this sort of interesting quirk that we have, this new marginal revenue function. Otherwise, it's the same sort of analysis we did before. So this should be doable with some practice.

Now, the key-- a key concept here that we need to think about, that comes to question, you might have asked yourself at some point-- you might have said, well, if monopolists are the only firm in the market, why don't they just charge whatever they want? Why do they have to-- why are they sort of constrained by the sort of mathematics we've done before? And to answer this, let's turn to the concept of market power.

The market power of monopolists we will define as their ability to charge price greater than marginal cost. Your ability to charge price greater than margin cost is your market power. In other words, competitive firms have no market power. They have to charge a price that's the same as their marginal cost. And that's why they make no money.

Monopolists have market power, OK? So now let's return to the condition for profit maximization. We said that marginal revenue can be rewritten as price times $1 + 1/\epsilon$ over the elasticity of demand, right? That equals marginal cost.

So we can rewrite this as marginal cost over price equals 1 plus 1 over the elasticity of demand. And this is the monopolist's market power condition. So if we define the market-- so we can define something we call a markup. Casually we can call it profits, but technically it's the markup, OK, as the percentage markup a monopolist can make as p minus MC over p , how much of the price is actually a markup over cost? It's sort of an intuitive concept.

So basically, how much of the money you get for the unit is a markup as a share of the money you get? Then that is simply-- that is equal to minus 1 over the elasticity of demand. So the monopolist markup is equal to 1 over-- minus 1 over the elasticity of demand. So if the elasticity of demand is negative infinity, that is a perfectly competitive market.

Then the markup is what? 0, just like a competitive firm. Competitive firms have to charge marginal cost. But as demand gets more inelastic the monopolist gains power to mark up the price and make money.

And this answers our question of why monopolists aren't infinitely powerful. What is the limiting factor of monopolists? It's not other firms producing their good. What's the limiting factor on monopolists? Yeah?

AUDIENCE: How much more will they compete with [INAUDIBLE]

JONATHAN GRUBER: Yeah, it's other products. So think about a monopolist in insulin. They can charge whatever the hell they want, right, because basically there's nothing else to buy. Well, maybe multiple insulin products, but imagine one insulin product, OK?

So nothing constrains the monopolist. He should charge an infinite price up to, like, what Congress will put up with, OK? But if you think about a monopolist in a good where there's a substitute-- so if I'm the monopolist in gum, if I'm a gum-opolist, OK, then I'm constrained by how much people want to-- eventually people just substitute the candy, OK? Anything-- so I'm constrained not by competitors in my market, but by the fact that consumers can substitute to other goods.

So what's the limit on monopolists? Consumers, we're the limit on monopolists. Our willingness to put up with that good relative to other goods, i.e. Our elasticity of demand, is the only thing limiting monopolists, OK?

So basically, there is market discipline to monopolists. Even though they're the only provider of a good they're still subject to market discipline. It's just the discipline doesn't come from other firms, it comes from consumers, OK?

So a great example of this is let's look, if you go on-- at least as of last year, if you go on Amazon and look at the prices of two goods that you've probably had to consume in high school, *Huckleberry Finn* and *Great Gatsby*, two books that many of you had to consume in high school. You had to read *Huckleberry Finn*, you had to read *Great Gatsby*.

They're both comparable lengths-- *Great Gatsby* is a little shorter I think, but they're both comparable lengths. The production cost-- the marginal cost to produce them is probably pretty comparable, OK? But if you go on Amazon, *Huck Finn* costs \$4 and the *Great Gatsby* costs \$16.

Now why is this? Why is this, anyone know? Why does *Great Gatsby* cost four times as much?

AUDIENCE: [INAUDIBLE] it was banned [INAUDIBLE]

JONATHAN GRUBER: That's interesting. That's not enough to explain. It's not banned in enough places, fortunately, to explain that. What else is going on, anyone know? Yeah, in the red shirt, yeah?

AUDIENCE: [INAUDIBLE] competitive-- it has, like, has no copyright infringement.

JONATHAN GRUBER: Exactly. *The Great Gatsby* still has copyright protection. That is, only people who get permission from the great-- from William Scott Fitzgerald's descendants-- F. Scott Fitzgerald, I'm sorry, descendents get to produce it. They have a monopoly on the good that is *The Great Gatsby*.

Huck Finn, it turns out that 75 years after an author's death copyright protection expires. F. Scott Fitzgerald hasn't been dead for 75 years, Mark Twain has. So *Huck Finn* can now be produced by anyone. You can go out tomorrow and produce a copy of *Huck Finn* and sell it.

So we think probably *Huck Finn* should be produced in a pretty competitive market.

That is, basically the \$4 you pay for *Huck Finn* should be roughly the cost of producing a book. OK, now no market's perfectly competitive, a little markup but not much.

Whereas *The Great Gatsby*, it's not limited by competition. But it is limited by the fact that if they try to charge \$500 for *Great Gatsby* teachers would assign something else, OK? There's still a limit.

It's only \$16, that's not a whole lot for one of the great works of literature, OK? It's still only \$16. So why is it only \$16? Because it's limited by the fact there are other great works of literature people can turn to.

So *Huck Finn* is limited by the competition within the market for the-- across producers producing some homogeneous good. It's probably a pretty close to the competitive market, right? It's pretty easy to just set up a shop and produce *Huck Finn*, whereas *The Great Gatsby* has this extra effect which is copyright protected, so its only limited by the elasticity of demand. Yeah?

AUDIENCE:

[INAUDIBLE] be like, [INAUDIBLE] like, the effect of, like, when you increase price again, and even more with piracy, in a sense? Like, if, like, when you have, like, a really, like, expensive good it leaves, like, more incentive to steal?

JONATHAN GRUBER:

That's a great point. So the elasticity of demand, I should say the elasticity of demand for that good, where one of the substitutes could be an illegal substitute. That's a good point.

OK, so let's go on and talk about the next topic I want to cover today, which is how do we-- because now we have a new set of tools we've developed that's really cool which lets us ask the question, not just what do monopolies do, but how do we feel about it? That is, we can now turn to talking about the welfare effects of monopoly. What are the welfare effects of monopoly? How do we feel about monopoly?

Well, let's start with the standard case, that is the case we've covered so far as opposed to a case I'll cover in a minute, OK? And let's look at figure 11-5, which is the example we just solved for, the example where demand equals $24 - Q$ and cost is $12 + Q^2$. So here we sh-- once again what do we do?

We set marginal cost equal to marginal revenue. So they sell 6 units. We then say,

what price permits them to sell 6 units? The price of 18.

So the equilibrium is at a price of-- is that e little m, little m for monopoly, OK? They sell 6 units at a price of 18. Well at that equilibrium, what's consumer surplus? It's A, the area under the demand curve, above the price.

So consumer surplus is area A. What's producer surplus? It's B plus D, the area below the price above the supply curve, but only for the units that are sold.

So the consumer gets A, the producer gets B plus D, OK? But C plus E is not our units that are not sold for which the marginal-- for which the willingness to pay is above the willingness to supply. And what do we call those units? Units that are not sold-- someone raise their hand and tell me-- units that are not sold for which the willingness to pay is above the willingness to supply? Yeah?

AUDIENCE: [INAUDIBLE]

JONATHAN GRUBER: Loss. Those are units, that's an inefficiency. Those units that are not sold that efficiently should be. That is, we've broken-- this our first example ever. This is a super exciting moment of breaking the first fundamental theorem of welfare economics.

The first fundamental theory of welfare economics was that the equilibrium, the competitive equilibrium maximizes welfare. Well, that's no longer true. Here we have an equilibrium that comes out of competition. It's what the market delivers, but it doesn't maximize welfare.

There's a dead weight loss, and that's because the market's imperfectly competitive. This is our first ever example of what we call a market failure. And that's what, from my perspective, makes economics fun. If there were no market failures, if all markets functioned the way we said they function, then basically we could have been largely done with the course by now.

What makes this all interesting is markets don't function the way we said they function in that extreme case. And therefore, a market failure is defined as a case where the market equilibrium does not maximize social welfare. So whenever the market equilibrium does not maximize social welfare, you've got a market failure.

In the perfectly competitive case we didn't have a failure because the market equilibrium maximized welfare.

That's not true here. Now the market equilibrium does not maximize welfare. Therefore, it's a market failure.

Hint, what's exciting about that to me is that means there might be a potential role for policy, OK? So far in this course, the government's just been a bad guy. Its done nothing but set mean minimum wages and things like that, and terrible price ceilings. But in fact, as we'll see next time, this starts to introduce the role for the government as a good guy, OK?

Now, what makes-- to drive this situation home, make this more interesting, let's contrast that to the more realistic case of price discrimination, or potentially more realistic case of price discrimination. Now what happens if we don't force the monopolist to only charge one price? What if we allow the monopolist to charge different prices to different consumers?

Here's a cool conclusion actually, kind of crazy conclusion. If monopolists can perfectly price discriminate, that is that they can sell a separate price for every consumer, then monopoly is welfare maximizing. If monopolists can set a perfect price for every consumer, then monopoly does maximize social welfare. To see that, simply look at figure 11-6.

Now let's take a perfectly price discriminating monopolist. Let's think about what-- this prices they've set. Well, essentially what they're going to do is set price where? A price discriminating monopolist is going to set the price for each unit to what? Yeah?

AUDIENCE: The demand.

JONATHAN GRUBER: The demand, the willingness to pay. If you're perfectly price discriminating, you will screw consumers to the max. And how do you do that? By delivering them no surplus. By taking all the surplus for yourself.

So for the first unit, you charge 5. For the second unit, you charge 4. And for the sixth unit you charge 18.

Now, the [INAUDIBLE]-- now the previous monopolist stopped at 6. Why do he stop at 6? Because the sale of the seventh unit would have lost him money. He would've had to lower the price on all previous units.

But the price [INAUDIBLE] monopolist has no poisoning effect because he doesn't have to lower the price on the previous units. He can say for that seventh unit, I'm going to sell that one at 17. I'm going to make 17, and I'm not going to lose any money because I can keep the other prices the same.

So with a perfectly price discriminating monopolist, you get rid of the poisoning effect. They can just march their way down the demand curve, charging every consumer exactly their willingness to pay. Therefore, they will continue to produce until the competitive equilibrium. They will continue to produce until willingness to pay equals willingness to supply.

But they will capture all the surplus. So the new equilibrium will be EC, the competitive equilibrium, but the entire surplus goes to the monopolist. So the fascinating case, there's-- we maximize social welfare, but only because we define social welfare in this particular way, which is the simple sum of consumer producer surplus. Here, producers get all the surplus, therefore welfare is maximized.

So a perfectly price discriminating monopolist, OK, gets maximized social welfare, OK? Now, there's two interesting points to come out of this. Point one is this is a cool way to understand why there's a dead weight loss for monopoly.

It's cool to understand because you can see- you can focus on that point E sub M and think about why the perfectly price [INAUDIBLE] monopolist gets to sell another unit and the regular monopolist doesn't. Because the regular monopolist has the poisoning effect and the perfectly price discriminating monopolist does not. So it's a good way to sort of think about that intuition of the poisoning effect. That's lesson one.

Lesson two is, gee, we may want to talk about definition of welfare that's not just the sum of consumer producer surplus. A model of welfare that delivers the fact that a producer that can screw every single consumer out of any of their surplus is the best possible outcome might not be a model we're so happy with, OK? But that we can come back to.

But for now it's a nice extreme. And in fact, in reality no firm is perfectly price discriminating, OK? Amazon tried to be. There was a controversy a number of years ago where Amazon would set your price according to your-- what's the little, the string of numbers address, IP address. They literally would set prices by IP address.

They'd literally say, well you know, you're coming from an IP address that's, for example, you're in a high-high income area. I'm going to charge you more. You're in a university, therefore you need this book for a course. Therefore, I'm going to charge you more, et cetera.

That, they got busted and that was found illegal. But just because you can't perfectly price discriminate doesn't mean we don't have lots of examples of partial price discrimination. So what are examples in the real world of price discrimination? What do firms do?

And what's the general-- let me ask, tell me what firms do. And also I wonder, what's the general principle? What's the basic idea that firms-- if you want to price discriminate, what do you want to figure out? What is your goal to figure out? Yeah.

AUDIENCE: Isn't [INAUDIBLE] make airplanes?

JONATHAN GRUBER: [INAUDIBLE] the what?

GRUBER:

AUDIENCE: Airplanes.

JONATHAN GRUBER: Airplanes. So explain.

GRUBER:

AUDIENCE: Because if know somebody is buying a ticket, like, two days before a flight, it's probably for a business trip so they can pay a lot more money.

JONATHAN GRUBER: And why are they willing to pay more money?

GRUBER:

AUDIENCE: Um, because the elasticity is--

JONATHAN GRUBER: The elasticity is low because?

GRUBER:

AUDIENCE: Because they have to do it.

JONATHAN GRUBER: They have to go. If you're going to buy two days before, you got to go. If you're buying six months before, you know, you might have to go that day, you might not have to go that day. You might have to-- but if you're buying last minute, you've got to go so your elasticity's lower.

So price discriminating monopolists look for signals of elasticity. That's their search. They can't literally know your willingness to pay. Amazon tried, but even Amazon couldn't perfectly know your willingness to pay.

So they're looking for signals that are correlated with your willingness to pay. One signal is whether you want to fly at the last minute. That means you have a low elasticity. You're screwed, you've got to go.

What's another thing airlines do? What's another signal of elasticity the airlines use? How else-- yeah.

AUDIENCE: How long have you been on the website?

JONATHAN GRUBER: They don't-- I don't know if they actually use that, how long you been on the website.

GRUBER: They could, that would be kind of interesting.

AUDIENCE: [INAUDIBLE]

JONATHAN GRUBER: Yeah, I don't know. But that, that's pretty subtle. What's a more blunt one they used even before websites? Yeah?

GRUBER: They could, that would be kind of interesting.

AUDIENCE: Search history?

JONATHAN GRUBER: No, even before search-- I know you guys grew up with internet but there was life before the internet. And even before the internet, airlines price discriminated. What did they-- what did they do? In the back, yeah.

AUDIENCE: You have, like business class and--

JONATHAN GRUBER: Yeah, different levels of flight, right? Why is a first class ticket more than a coach ticket? Because rich guys are less elastic than poor guys. So basically, another way

of price discriminating within the same flight is by having different quality.

So what they do is they say, we're going to give you a higher quality product, but look, first class business-- so I flew business class for the first time in my life. I was very exciting. I went to India, I flew business class. It was awesome.

But it raised the price of the ticket from \$1,000 to \$2,500. Now, it was better but it wasn't \$1,500 better. Or [INAUDIBLE] put this, let me rephrase that. It cost more, but it's certainly didn't cost \$1,500 more.

I got a bigger seat, and like, you know, people slaved over me. But like, it certainly did not cost them \$1,500 to provide that service. They clearly made more of a markup on the business class seat than they did in the coach seat because I was less elastic. Why? Because someone else was paying for my flight, OK, so as less elastic.

And that's-- if you talk to people in business class, none of them are paying for their own flights. They're either super rich or their company's paying, OK? So the bottom line, that's another way airlines [INAUDIBLE].

Let's get away from airlines. What are other examples of price discrimination? Yeah.

AUDIENCE: Isn't that a common thing, like, Google, like, [INAUDIBLE] actually use your search history and cookies to, like, figure out how much money you make and how much you're willing to spend on certain items?

JONATHAN GRUBER: I think-- I have to look this up. I think they're not allowed to do that. They're allowed to do that in targeting advertising, but I don't know if they're allowed to setting the price. I don't know if a company's allowed to that setting the price. Yeah?

AUDIENCE: Sometimes chains will be more expensive in cities and less expensive in rural areas. Like, the same meal at McDonald's can cost a different amount depending on--

JONATHAN GRUBER: Exactly, or-- that's exactly right. Restaurants or supermarkets. Now here's what's interesting, if you look at a McDonald's, OK, its prices-- no, it's true for both. Basically, if you look like, like if I buy-- when I buy McDonald's on the highway out in the suburbs it's more expensive than I would buy here in Cambridge. Why is that? Why is-- why is a big so-- yeah?

AUDIENCE: Not a lot of other options.

JONATHAN GRUBER: Yeah. I'm like, I'm driving. Where am I going to go? I can't say, oh, it's too expensive, I'm going next door.

So that's an example. Inner city price-- supermarkets charge much higher prices in the city than out of the city. Now you might think that's sort of strange, OK?

But that's because in the city people have to walk to get there. They don't have a lot of options. There's not a lot of shopping. Outside, they can drive from supermarket to supermarket, OK?

So there's all these complicated things that go into it. One of my-- let me sort of tell you a couple of my favorite examples. One of my favorite examples is early bird specials. Now you guys might not know about this, but you might've hung out with your grandparents and known that, like, if you go to a restaurant sometimes before 5 o'clock or 5:30, it's cheaper.

Or if you go to a matinee movie, a movie during the day is cheaper than a movie at night. Same movie, why? Why is a movie during the day cheaper than a movie at night? Yeah.

AUDIENCE: Because in the night time you probably want to go to the movies more because you're off work and you have things to do. And so there's like-- like, if you went early you're purposely looking for a cheaper option. So you [INAUDIBLE].

JONATHAN GRUBER: You're more elastic during the day because basically you're an old retired person's who's got nothing but time in their hands. It's like, you can shop around movie theaters, you decide to go to movie or take a nap, et cetera. Same thing with early dinner specials. People who have more time to shop are more elastic.

At night you're going out to see the movie. These are people, you know-- in some sense it's sort of interesting. You think midnight movies-- I don't know if this is true, midnight movies should charge and most of all. Because that's a bunch of insane fans, right, who have to see the movie first.

It seems like the midnight showing should charge the most. I don't know if that's

true. That would be interesting to look at. OK, that's one example.

Another example I love is Disneyland. Disneyland and Disney World charge less if you live within 20 or so miles of the park. Why? Because you can go whenever.

So when I took my kids to Disney World, if I went up and said, I'm sorry kids, it was \$10 more than I thought, we're not going, I would have had a riot on my hands. Once you're there, you're inelastic. You're going to Disney World.

There's nothing else to do in Orlando. I mean, but there's other parks, I guess. But like, but if you live locally you can decide whether to go or not.

And then probably the most interesting recent example is Tesla. So during-- I feel like, did I tell you guys the Tesla hurricane story yet? I don't think so, right?

OK, so during the hurricane in Florida-- Irma, I guess it was? In Florida, Tesla-- so Tesla so two cars, two models, the cheaper model and the more expensive model. And the more expensive model had some nice doodads, but most importantly the battery lasted longer. The cheaper model was like 300 miles, the more expensive model was like 500 miles.

During hurricane Irma, Tesla as a gesture of goodwill said, hey guys who drive the cheap car, you can now drive 500 miles. And they're like, what the hell, it's the same battery? Tesla said, well it turns out, it's the same battery. The only difference is a piece of software that we can turn off or on.

So why did Tesla do that? Why did Tesla have a piece of software they turn off or on and turn it off for some people to make them drive less? Why did they do that?

There's someone else involved. Can anyone tell me about what Tesla thought, meaning besides the, oh, must be an asshole. What else? What's the other-- what's the kind of-- what's Tesla's thought process? Actually, it was perfect economics. Yeah?

AUDIENCE: Price discrimination.

JONATHAN GRUBER: Right, it's price discrimination. But how? How are you price discriminating by making some people-- yeah?

AUDIENCE: You can make a 500 mile car more expensive.

JONATHAN GRUBER: Exactly. It's like first class. You're basically saying, I want to charge more for a better product. I can't charge more for the same product, so if I give everyone 500 miles I can't charge more. But by making one product better I can separate demand.

I can sell the expensive product to the low elasticity of demand consumers and the less expensive to the high elasticity of demand. But it's actually the same damn product, I just did it as a way to price discriminate. So Tesla, in an effort to be nice, screwed themselves by revealing that they had been actually falsely screw-- you know screwing consumers. It's not [INAUDIBLE]-- it's good economics. It makes total sense.

OK, this actually follows one last example. When the first laser printers came out, OK, it turned out that you could buy one for home that was like half the price one for office. And someone took them apart and found the one for home was the one for the office plus an extra piece that made it go slower.

And they did that simply because they knew the office guys were less price elastic than the home guys. So they wanted an expensive one-- so they said, the office one's faster. Isn't this cool?

It was faster because they didn't add an extra piece that made to go slower, OK? And that's the same thing. So let's stop there, and we'll come back and talk more monopoly. Good luck tomorrow night and we'll talk more about monopoly on Wednesday.