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[RUSTLING]

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**PROFESSOR:** OK. Today, we're going to do our second lecture on monopolies. Remember once again to set the picture. If we want to figure out how much producers are going to produce, we need to know what market structure they sell into. That's the final condition we need to pin down how much producers produce.

We started with a particular market structure, which was perfect competition, and showed how, under perfect competition with price equals marginal cost, we can pin down how much producers produce. We then turned last lecture to an alternative market structure, really the other extreme, which is monopoly with only one firm in the market. And we showed how that can pin down what producers produce.

But we also showed that monopoly breaks the link between the positive equilibrium outcome and the normative concept of efficiency, that we have an equilibrium outcome that, unlike with perfect competition, is inefficient. We create a deadweight loss because monopolists don't sell units that they can produce more cheaply than people are willing to pay for them. And they don't do that because they don't want to poison their sales. They don't have to lower the price enough to get additional sales.

Now, what we're going to talk about today is a couple of topics within monopoly. The first topic we'll talk about is where do monopolies come from? So how do monopolies arise, or the origin of monopoly, if you're a Marvel fan? Well, this is our origin story. OK. No radioactive spiders or anything. But rather, we're going to talk about markets where monopoly is inevitable and natural. In particular, we'll talk about today, natural monopolies. Natural monopolies arise whenever there's a market where for all relevant quantities, average cost is falling. In other words, fixed cost is so large relative to marginal cost.

You remember our typical average cost curve falls and then rises. We're going to have an example where fixed costs are so large, average cost is always falling. So for example, the classic example we use is producing rock from a rock quarry. You've got to dig up rock from this rock quarry. It's one resource. There's one-- for historical reasons, there's one geological site we can dig up rock. It's a huge fixed cost finding it, digging it out. But the truth is, creating a second rock quarry would be incredible fixed cost. So the fixed cost of doing another one is small relative to the ongoing marginal cost.

Or more generally, this is something where basically, you would see this in any of utility, like delivering water to houses. If you deliver water to houses, you have this incredibly expensive enterprise of laying all the pipes to deliver the water, and then the marginal cost is pretty trivial. You just pump the water through. So the fixed costs are so enormous that they're going to dwarf the marginal cost for any relevant quantity. And we'll see what that looks like in figure 12-1. Figure 12-1 is a picture where the average costs are everywhere above the marginal cost for all relevant quantities.

Now it's true, you could produce enough. There's some quantity for which average cost will fall below marginal cost and start to rise again. But basically, the idea is the range where average cost is falling extends to the entire relevant range, not just the beginning, as in previous examples. Why does this cause monopoly? It causes monopoly because it creates such a barrier to entry that no one else can enter.

Imagine you tried, imagine you saw this market. You saw this water utility. And you said, look, there's profits to be made, average costs above marginal cost. It's declining above marginal cost. There's profits to be made because average cost is falling. I'm going to enter. OK. What would the existing firm do? What could the existing firm that's already invested in the water pipes? You say, I'm going to lay a whole new set of water pipes, and sell water more cheaply. What would they do? What would the existing firm do?

Well, you're an existing firm. You've laid these water pipes. You have this graph in front of you. You're setting your price at some level well above marginal cost. What do you do? Yeah. Lower your price. If you lower your price to marginal cost, no other firm can make money because then price is below average cost, and you lose money. But for you, you've already paid the fixed costs. So for you, you're still making money in the marginal unit. So yeah, the existing firm just lowers its price towards marginal cost, below average cost.

Any other firm looks and says, look, I can't make back my average cost. I'm not going to enter. Once you scare them off, you raise your price back up. So in a market like this, it is natural, it's indeed proper to only have one firm. It makes no sense to have a second set of pipes going all the way through the town, delivering water to houses. It just makes no sense. So in this case, a monopoly is natural. And this is basically an example where a fixed cost creates a barrier to entry. The fixed cost is so large that you never enter.

Remember I talked about how we never have perfect competition because there's always some slight barrier to entry. Someone could beat you up if you try to sell additional little Eiffel tower figures or whatever. There's always some fixed, always some barrier to entry. Here, the barrier to entry is so large [INAUDIBLE] these fixed costs, basically no one's ever-- once someone's in, no one else is ever going to enter, and therefore, it's a natural monopoly. Yeah?

**AUDIENCE:** [INAUDIBLE]

**PROFESSOR:** Well, if there's nobody delivering water, there's money to be made because the first firm is a monopoly. We know monopolies make profits. So if there's no one, they can come in and lay the pipes and make money. Now, you might say, how do they know someone else won't come in and lay them faster? That's an interesting-- that's exactly the kind of fun stuff we don't have time to get into in this class. But if you take game theory, 1412, they'll teach you all about how we think about these different things. And I'll get into that. I'm going to do a couple lectures on game theory, but not nearly enough.

But think of it as one firm just happened to go first, and they own it. OK. Other questions? So that's one reason, one way monopolies can arise. Another way monopolies can arise-- so one way is a natural monopoly. Another way monopolies can arise is the government can create monopolies. The government can actually create monopolies.

One is by actually literally delivering the service. So in most countries, when they're young, governments do a lot of things we think is private now, like they run the airlines. They run the steel industry. They run the banks. And even in mature economies, governments still do some services like run the postal Service. There's activities that governments can just do and say, we're going to have a monopoly on them. And we are going to deliver these services.

Now, as economies mature, typically those get shifted off to the private sector. And we'll come back a little bit to that. But basically, that is one way. The more common way that-- so one way a government can create monopoly is through delivery. But the more common way a government can create a monopoly is through property rights, in particular patents and copyrights. We talked about copyright last time with *Huck Finn* and *Fahrenheit 451.* But a patent is basically an exclusive right to sell a good for some period of time-- in the US, 17 years, typically.

So the way a patent works is you file for a patent. If it's granted, then you are essentially a time-limited monopoly. You have the exclusive right to sell that good. So how do we feel about patents? Well, in fact, there's a good and a bad side. What's the bad side of patents? What's the bad side of offering patents? Yeah?

**AUDIENCE:** It's a monopoly.

**PROFESSOR:** It's a monopoly. You create deadweight loss. It's inefficient. What's the good side of offering patents? Yeah? Yeah. You basically-- why invent something if you can't make any money off it? They create incentives to innovate and invent because if there's no patents, the minute you invented something, someone could just steal it and produce it at marginal cost or marginal cost plus epsilon. You wouldn't make any money. So why put the work in?

So it's a trade-off with patents between incentives for innovation and monopoly costs to consumers. So basically, the optimal patent trades off these concerns. You want a patent that gives enough rights to incent innovation and not so much rights that you overly hurt consumers.

So for example, let's take pharmaceuticals. Developing a new drug is incredibly expensive. Roughly speaking, about one in every 10,000 compounds you try is going to end up working in terms of being an effective drug. Once you have a compound that you think works, you do animal testing in phase-- then you have to do three levels of human testing. The best estimates, although they're rough, is that developing a new drug in the US today costs about $2 billion. About $2 billion. Not if you knew ahead it was going to work, but if you take all the failures along the way, on average, by the time you develop the drug, you spend $2 billion. That's a lot of money.

So basically, what we do is we give a patent for 17 years, and then when the patent expires, other companies are allowed to enter and produce what's called generic drugs. So you have a name brand drug. You invent it. You get 17 years. And then after those 17 years, anybody can enter it. The formulation becomes public, and they just produce it at marginal cost, and your profits all go away.

In theory, that's how it works. And in theory, we'd have an easy solution. We'd just say, well, set up an optimization problem where you optimize the incentives to innovate versus the losses to consumers. Clearly, the optimum will not be a patent lasts forever. And clearly, the optimum will not be no patent. It'll be somewhere in between-- who knows the 17 years, right? But you could-- economics gives the tools to think about this trade-off now, right?

The problem is, in practice, it doesn't work that well. There's a lot of problems with the patent system. The first is that companies have a lot of incentive to think up creative ways to effectively extend their patent. So for example, one thing drug companies will do is do something called pay for delay. Let's say I've got some name brand drug, and Pedro is a potential generic innovator. He wants to enter and make my drug.

And I say, Pedro, look. I'm making like a billion a year on this drug. You're a generic guy. You're not going to make much money because you're coming to a competitive market. I'll pay you $500 million not to come in. Pedro is like, great! I didn't do shit. I got $500 million. I'm still making $500 million in profits. So I can effectively extend my patent.

Or what I can do is I can tweak the formulation and apply for a new patent. So for example, insulin is incredibly cheap to make. And it was invented-- the inventors were academics who gave away the patent for $1 because they wanted to be publicly available, but it costs a ton of money. Why? Because there's all these innovations in delivering insulin that make it a little more efficient, a little better. Now they are true innovations, but each one extends the patent and makes insulin more expensive. And that trade-off is not really what were-- that's a different way than the system is supposed to work. So that's one reason this doesn't work.

The other reason is that generic markets aren't as competitive as we'd like to think. So EpiPens, which are now-- epinephrine is a generic drug-- still costs $600. Why do pens cost $600? Because it turns out it's expensive to make an EpiPen. The delivery device and stuff is expensive, and firms aren't entering. And as we'll talk about starting next lecture, unless you have perfect competition, there'll be profits, and there'll be deadweight loss. OK, that's the second reason.

A third reason is the biggest challenge yet, which is for the new class of drugs being made called biologics, which are not stable, large cell drug development, but literally, drugs that are developed and injected and are essentially formulated, they are biological formulations that are live, effectively. It's hard to make an effective generic. And so generic competition may simply not exist for these new biologic drugs, which is the new class of drugs which are making incredible steps. And let's be clear, the innovation of pharmaceuticals is unbelievable. OK?

Just one example-- there's a horrible, horrible disease called spinal muscular atrophy. If the baby-- it's a genetic disease, purely random. If you're born with it, your life is brutal, miserable, and you're dead by 2. I mean, awful. Can't imagine anything worse as a parent. They've cured it. They developed a miracle cure. It's a new called cell and gene therapy. We literally inject a virus in the baby's body containing a new patched gene. It goes through the body, and repairs it. It's a miracle. It's the kind of thing you guys are doing here at MIT every day. And it's only going to get better.

This drug costs $2.1 million. Now, on the one hand, they say $2.1 million? That's a lot of money. On the other hand, you're saving a baby's life. You're adding potentially 80 to 100 years of life to someone. $2.1 million is actually a pretty good deal. On the other hand, if we develop drugs for everything like this, we'll bankrupt our country. So these are the kind of difficult issues we raise and want to give incentives for innovation, but also being ultimately affordable in terms of what consumers need to buy. OK? Questions about that?

And if this is something that interests you, this is a big debate in the US right now. It's part of President Biden's Inflation Reduction Act, the IRA. The government, for the first time, is actually regulating the price of pharmaceuticals. It's actually saying to some pharmaceuticals that have competitors, look, we're going to regulate your price because we think you're making too much money.

The government has decided the patent system isn't working. It's out of balance. And some drug companies are making too much money, and they're regulating prices. And that was very controversial and a significant step forward in how we think about drug pricing in the US. And you can read more about that if that's something that interests you. And certainly if you want to go into biology, biological engineering or any of those fields, this is something important to know about. So that's the first topic I want to cover. Where do monopolies come from?

The second topic I want to cover is addressing monopoly because this is where things get exciting from my perspective. I'm a big government liberal. OK, I think government can do good things. Yet, everything I've taught you in this course, government is the bad guy. OK, I don't like that. But that's the way basic economics works. And let's be clear, that that's the proper way to teach the first half of this course. The first fundamental theorem of welfare economics says government only does bad things.

But that's not true in reality, and here's the first case we get to see where government can potentially, but not obviously, make things better. And that is through regulating monopolies. So for example, let's go to figure 12-2. Figure 12-2 is the same figure we ended with last time. You've got a marginal cost curve, a demand curve, and a marginal revenue curve. The marginal revenue curve intersects marginal cost at six units. Producing six units, you respect the demand curve, you charge a price of $18. Six units get produced. We get a deadweight loss of C plus E.

So as we said, the market outcome is not efficient. What can the government do? Well, what if the government set a price ceiling, and said, we are not going to let the monopolist charge more than $16. We will not let the monopolist charge more than $16. Well then, the new marginal cost curve for the monopolist, the new supply curve or the new-- it's essentially the new marginal revenue curve-- I'm sorry-- the new marginal revenue curve becomes the flat line all the way to point E. What is that? EC, it should be-- that intersection of the red and blue lines.

The flat line all the point that little E0, I guess. It looks like it should be EC. And then it drops the dashed line down. You go back to the old marginal revenue curve. So you draw the solid line from the 16 on the y-axis over to what looks like E0, follow that dashed line down, and then rejoin the original marginal revenue curve. That's the new marginal revenue curve. Why?

Well, think about what marginal revenue is. If you produce-- remember, in the old world, if you produce a seventh unit, OK, your marginal revenue, your profits fall because the poisoning effect. But now if you produce the seventh unit, you can only charge $16. That's the most you can charge. So you might as well produce it. If you can only charge $16, if that's the limit, then at that point, your costs are below your marginal revenue. So you produce in other words, the marginal revenue.

In the old point, when you went to the seventh unit, marginal cost was above marginal revenue. Now going to the seventh unit, it's not because we haven't let you raise your price. So the government, by regulating and saying the price has to be set at $16, is essentially taking away the poisoning effect. The poisoning effect arises because if I want to sell one more, you have to lower my price. Well, here, your price is already low. I haven't let you raise your price. I haven't let you set it at $18. Before, you didn't want to sell a seventh unit because you had to lower your price to $17, right?

Well, now your price is already $16, so why not sell the seventh unit? $16 is still above marginal cost, so why not do it? So essentially, the optimal solution for the monopolist then is to sell 8, to sell the competitive quantity. If you tell the monopolist they can't charge more than $16, they will sell the competitive quantity. And guess what? Deadweight loss has gone away. We're now selling the competitive amount, and deadweight loss is going away.

So let's think about an example of this and how the government could make things better. And let's come to a case of a natural monopoly, which is broadband delivery. To deliver broadband, it's not a fully natural monopoly in that multiple people can lay the lines that come to your house, but it's a big fixed cost. If you want to set up a broadband competitor, you have to go out and lay a whole bunch of new fiber cable.

That's expensive. It's not infinite. It's not a water utility. It's doable, and it happens, but it's pretty expensive. Competition will be definitely limited. It may not be a natural monopoly, certainly a natural oligopoly. You're not going to have hundreds of firms laying these wires making prices competitive. So for example, across 20,000 US zip codes, 70% have either zero or one option for 25mb per second service. OK. 0 or one option. Is that right? Is it megabytes per second? Did I say that right? I think so. I hope so. Mbps, I think I got that right.

Zero or one options. Even at the lowest possible speed of internet service, only 30% of zip codes have more than one option for getting broadband. 30% of America has only one option for getting their broadband. Why? Because it's a natural monopoly in many cases. The costs are really high. If you're in some rural town, it's not effective to lay a second set of wires going to people's houses. As a result, prices are high, and there's monopoly power.

Now, you might say, well, John-- and the broadband company will say, well, John-- because they have deep voices-- John, how do we have monopoly power? Just because there's not that many, we still could be pricing competitively. Well, economists have developed a very clever test whether it's monopoly power, which is they ask what happens to prices as more firms enter? If a market is competitive, what should an additional firm entering do to the price?

No. If a market is perfectly competitive, what should additional firm entering do to the price? If it's perfectly competitive, price is already set to marginal cost. It shouldn't do anything. Price is already marginal cost, so additional firms shouldn't have a meaningful effect on the price. Maybe it'll go down a little, but not meaningful.

If it's a monopoly market and you add a second firm, price will come down a lot, and we'll prove that next lecture. So the way to test this is to ask what happens as more firms enter markets? Do prices come down a little, or do they come down a lot? And the answer is, it comes down a lot.

So basically, for gigabyte internet, moving from one provider to two providers of gigabyte internet lowers the monthly price by 60 bucks a month. Literally, you pay 60 bucks less a month for gigabyte internet when you go from one provider to two providers. That is not a competitive market. OK? So obviously, there are huge monopoly rents being made in these markets.

So what can we do? Well, the answer is easy. We regulate the price. We say, look, we're going to regulate the price at a level. You can't regulate it at truly marginal cost because then no one will enter. It's a question I got before. Why would anyone enter? But you say, look, marginal cost, this is what we do, for example, with electricity and water. Those are public utilities. The way we regulate is we say, look, you have an acceptable profit rate we'll let you make-- 10% whatever it is-- and we'll regulate the price at the marginal cost plus that profit rate.

You do the same thing with broadband. We already do it with electricity and water. We have plenty of electricity and water in the US. Why not just do the same thing with broadband? Indeed, that's what they do in Europe. In Europe, they have quite an interesting approach. They have a different-- they regulate the price, but actually, they do a different kind of regulation in Europe. The public owns the lines, and the companies compete on sending the signal over the lines.

It's kind of a clever approach. The fixed cost part is laying the lines, right? The marginal cost part is sending the signal over the lines. So the government owns the lines, and companies compete on who sends the signals. And broadband, if you've ever been to Europe, is incredibly cheap compared to here. OK?

That's one way to do it. Or alternatively, if we don't like that, we could just regulate the price. So why don't we just do that? Why don't we just do what figure 12-2 suggests? Well, the answer is because it turns out to be hard because we don't get these handouts in the real world, OK? In the real world, we have to figure out what the competitive price is, and that turns out to be hard. It turns out to be hard because we need to know what demand curves look like and what supply curves look like, and both are hard to measure.

Let's start with demand curves. You might say, look, it's easy to measure a demand curve. You just ask people their willingness to pay. You say, literally, I go and I do a survey of all the customers of broadband, and I say, how much are you willing to pay for each of these different options for broadband? And then I regulate the price.

The problem is, people have no [AUDIO OUT] idea what it's worth to them. People don't know. When you ask people what stuff's worth to them, and it is something they buy all the time, they don't know. If you ask me what an apple is worth, and I say, well, I've gone to the store and apple, an apple costs about, it's about $0.80 or $1 for an apple. But for a good apple per pound, I can get a sense. If you said, would you pay $5 for an apple, I'd say no.

But I don't honestly know. I mean, if you said, would you pay $1,000 a month for internet? That's too much, and 0 sounds cheap. But $60, $100, $150, I have a harder time figuring out what's a fair price. OK. This is obviously an even bigger problem when you think, not just about regulating broadband, but regulating things like the environment, regulating things like stopping oil spills or global warming.

So for example, if you ask people what environmental benefits are worth, they have no idea. So for example, if you ask people what it's worth to save the Grand Canyon, and you first ask, as a standalone question, and then separately ask as one of five questions, in the second case, people give a value that's one-fifth as big. It shouldn't matter, right? It's just a value. But the problem is they don't know.

If you ask people how much they'll pay to save a whale and save a seal, if you ask them how much they'll pay to save a whale and save a seal, they'll pay $172 to save a whale and $85 to save a seal. Sort of makes sense. Whales are bigger. OK, if you ask the order reversed and say that how much to save a seal and how much to save a whale, people say they're about worth the same. If you ask people how much they'll pay to save 1,000 birds or a million birds or a billion birds, they give the same answer. None of these things are consistent with any form of utility that we write down in this class. People clearly don't know, so it's hard to measure demand.

It's easy to measure demand when there's a price signal, when you see different prices and you see what people want, different prices. But when you're trying to create a new market and you have to rely on willingness to pay, that's hard. That's the first problem. Demand curves are hard to draw.

The second problem is supply curves are hard. Now you might say here, well, it's easy. You just go to the firm, and you say, well, give me your marginal cost. And that's great. And what does the firm say when you say, give me all your costs? They say, sure. And what do they give you? If you're running a firm. What would you do?

Yeah. You would give them the biggest possible marginal cost you could ever justify in the world. Remember my story about the CEO who wanted his own plane? That's nothing compared to this. The problem is, you're trying to regulate an industry that knows more about itself than you do. So it's hard to know what supply is either.

So the problem with regulation is that you can't just draw these neat diagrams. You have to guess at them, which is fine, except if you get it wrong, you can make things worse. Take a look at figure 12-3. Imagine the government decided that it would set the price at $10. It had some base setting the price. It got its own demand curves and supply curves. They decided $10 was the competitive price, whereas we know the right competitive price is $16. What happens if the market sets the price at $10?

Well, the price of $10, the optimal monopoly choice-- you should solve this for yourself-- is to produce five units at a price of $10. Well, that creates even bigger deadweight loss than if you just let the monopoly rip. You've lost an extra, that extra shaded area from regulating the price at $10. So the government has made things worse.

It can be even worse if you let the price low enough. You could just kill the industry. The industry can say, I'm not going to form at all because the price is too low. How would you know? If the industry didn't exist, how would the regulations killed it? OK?

So basically regulation is tricky. There's a recent research paper I learned about where someone looked at what happened when the Food and Drug Administration, which regulates medical devices, loosened the regulations on categories of medical devices. You want the regulated devices, right? You're worried about safety. You want some regulation. When you loosen the regulations, they found innovation went up 1,000%, and there was no worse safety. Clearly, they were overregulating these medical devices because it's hard to get it right.

So here, we see exactly what the trade-off is with government intervention. And this is the point of my entire course, 1441, which is markets typically feature market failure. There's honestly, truly, almost no market in America doesn't reach a market failure of some type. If there's a market failure, then in theory, the government can make it better. In practice, it's not clear it will. So the fact there's market failure does not justify you saying that a government regulation will make it better. It might make it better. It justifies considering the government regulation. But you still don't know what makes it better until you do the careful empirical analysis. OK? Questions about that?

Now let's say you're worried about that, and you're worried, you say, look, I'm really worried about regulating, but there's this monopoly, and its consumers are losing out. And I don't know what to do. Well, there's another option governments have, which is governments, rather than creating monopoly in the way it does up there, governments can reduce monopoly by injecting competition into markets. And there's no better example of that than the market for education.

Take a look at figure 12-4. Figure 12-4 is from my textbook. It shows educational spending in blue by each country, per student. So the US is about almost $12,000 per student. The Czech Republic is about less than $6,000 per student. In orange, it shows that country's performance on an International math exam. Czech Republic does better than the US. Indeed, the US, despite spending by far the most per capita on education, is pretty mediocre in international comparisons of education systems.

Now, there's lots of reasons that could be. But clearly, our schools are not getting it done, are not delivering the proper return for our dollar. One solution to that is to say, well, part of the reason they're not is because schools are monopolies. How many of you went to public school? How many of you went to-- most of you. OK. Public schools are monopolies.

I live in Lexington. My kids, if they want to go to public high school, go to Lexington High School. It's not like I can say, I'd prefer to go to Braintree High School instead. I don't have that choice. I have no choice. It's a monopoly. Now, in some cities-- it's not quite right-- some cities do have a choice of say, elementary schools. Some of you may have, if you ever grew up in Chicago or Cambridge or some cities where you can choose your elementary school. But typically, you can't choose. The choice is not a feature of public schools.

So the idea is, since the fear is, since we've created these monopolies, have we created inefficient schools that are not delivering proper benefits? Because remember, I said monopoly, they can make profits. Well, if it's a monopoly, where you can't make profits, but there's no competition, the other way can come out is just not doing good-- not being efficient. There's no incentive to be efficient.

If you have a monopoly, we could set your price then there's every incentive to be efficient, because every dollar of efficiency gains $1 of profits. But imagine you're a monopoly that can't set your price. Why work so hard to be efficient, right? What's the pressure on you to do so? Why not have a slightly easier life? And that's the concern that's happening with schools.

So that's why there's a big movement to introduce competition into the US public school system. One way to do so as I said, some schools have introduced what we call public school choice. They've allowed students to choose across public schools. And the dollars follow the students. So if you're a shitty elementary school and folks leave, you get less money. So suddenly it matters. Quality matters for how much money you have to function. And that's one approach that's been tried. Generally does not seem to show it has a huge effect on student performance.

The other approach that's been tried is to set up alternatives to the traditional public school. And the most popular of those, the most well known, is charter schools. Did any of you guys go to charter school? Yeah? Charter schools are essentially non-traditional alternatives that are publicly-funded. So the idea is you've got your Lexington High School, and you've got your Achievement Academy, charter school. And that charter school-- often they're for profit, sometimes they're nonprofit-- are essentially places students can go. They're still funded by the public sector, but they are not abiding by the same set of rules necessarily. For instance, they don't have to hire unionized teachers, et cetera. And they provide a competitive alternative.

And in fact, charter schools have been shown by my colleagues here at MIT who've done the leading research in the world to be generally a very effective alternative to private-- to public schools, that students who go to charter school, when you put in a charter school, students do better. The competition is working in the context of education by having these educational alternatives.

So here's a case, and in particular, let me say in particular, for disadvantaged students, the group that benefits the most from charter schools are minorities and low-income students. They benefit the most from having this alternative. So here's an example of another way governments can try to deal with market power is by introducing alternatives. So the bottom line is governments have-- the bottom line is monopolies exist, OK? The fact that they exist creates deadweight loss in the market. In fact, it's good that they exist in many cases like pharmaceuticals. We want patents.

But at the same time, we want to figure out the optimal way to deliver innovation but minimize the loss to consumers. Government regulation is one way to do that. Another way is by increasing competition in the market. OK. Questions about that?

OK, let's come to the third point I want to talk about, which is an important concept that starts to lead us towards a more subtle way of thinking about markets. We've thought about two extremes. We've thought about perfect competition and monopoly. Starting next time, we're going to start talking more generally about oligopoly and in-between cases. One bridge to that is the notion of what we call contestable markets. Contestable markets.

A contestable market is one where there is a monopoly advantage, but it's not so big. It's like a natural monopoly, but with an actual partisan so large where there's some fixed costs. They're pretty big, but they're not so big that someone couldn't enter at some point. The idea here is there will be a monopoly, but it won't make that much money. The idea is there'll be a monopoly, but if it tries to set price too high, then it will cover fixed costs and firms will enter. So monopolies are in a contestable market. Monopolies have barriers to entry, but they're not so big that they can go nuts and charge full monopoly prices.

And the most famous example of this was in the era of airlines. When I was a kid, airlines were a regulated monopoly. If you wanted to fly from A to B, you had to apply to the government. They gave you permission to fly from A to B, and they regulated the price you could charge.

And in that world, basically, the view was governments didn't do a very good job, and airlines made a lot of money. The view was governments-- because remember, the airlines lie about their marginal costs, and the view was governments were in their pocket, and the government was setting prices too high. And airlines are making a lot of money.

And economists said, you know what? You don't have to regulate this industry. Yeah, it's a natural monopoly, but it's also very contestable market. The fixed cost barriers aren't that huge because there's lots of planes for sale. Planes that are a couple of years old still work really well, and other airlines can buy them. This is actually not that hard an industry to enter. I mean, it's hard. I can't enter it, but it takes tens of millions, not billions to get into this industry.

So actually, if we get rid of regulation, we can actually do better than if we keep regulation. You're in a case where essentially, you're setting the price so high that if you just let competition work, it will do better. And economists actually won the day. Economists convinced the government to deregulate the airline industry.

So what happened? Three things-- first, prices fell enormously. Economists were right. Prices fell by about a third. The unregulated prices were about 2/3 of what the regulated prices were because economists were right. The government had set the price too high.

An example is that when I was at MIT in the 1980s, I would fly home to Newark on People's Express. People's Express, which sounds like a Communist organization, was this new airline that was introduced in the new deregulated market. In 1984, the market had only been deregulated about a decade. So this new airline, and I would fly from Boston to Newark for $19.99-- $19.99. OK? I mean, now it's a few hundred dollars. And it was before that airline, also a couple hundred bucks.

Literally didn't even reserve a spot. You just literally showed up and lined up. When the plane was full, they took off. I don't know. They came through with a cart, and you paid on the plane. I don't know, if you didn't have money, did they throw you off? I don't know. But literally, it was so cheap to fly. Prices came way down from what they used to be.

The second is the number of routes that were flown went way up because it turns out there were lots of routes that were profitable to fly. The government wouldn't let happen. It turned out airlines say, well, look, if you let me charge what I want, I can figure out a way to make this route profitable. So there's a huge increase in access, huge increase in where planes went at a much lower price.

Third effect-- service quality tanked. Flying used to be fun. When I was a kid, everything was free. You got in the plane, free food, free booze, real silverware, huge legroom, no charge for anything, free bags. Any of you watch *Mad Men* and watch Don Draper fly, that's what it was like. He's not even necessarily flying business class in those shows. It was awesome. Flying today sucks. We all know that.

So why did that happen? Why did quality deteriorate so much? When we deregulate airlines, why did quality fall so much? Yeah?

**AUDIENCE:** That's really funny because we're doing a project in another class about People's Express.

**PROFESSOR:** OK.

**AUDIENCE:** Long story short, in order to have such good customer service, you have to burn through a lot of employees. And so your attrition rate is going to be really high. And as a result, as soon as you start getting market share for People's Express, legacy airline carriers cut the prices.

**PROFESSOR:** Yeah, I mean, that's a little more detailed answer than I wanted. But basically, the bottom line is when you are regulated on price, but you have different planes flying the same route, how do they compete? On quality, right? In the markets we've discussed so far, the only way firms can compete is on price. But firms can compete, in reality, on multiple dimensions.

So in the old days, if United and America were both flying to Chicago and they had to charge the same price, how did they get your business? By being a nicer experience. Now suddenly, if they can compete on price, they say, we're not going to be nicer experience anymore. It's too expensive. We're just going to charge a lower price.

Now you might say, well, gee, that sucks. That's a terrible thing. It's horrible airline quality. Why would I tell you you're wrong? Why would I tell you it's good that airline quality fell. Why can't I say for sure we're better in a world with lower prices and lower quality than we are in a world with higher price and higher quality? Yeah?

**AUDIENCE:** [INAUDIBLE] the deadweight loss.

**PROFESSOR:** Well, I don't know that only because I drew a graph in prices. I didn't draw a graph in quality. I don't know that we got rid of the deadweight loss, for sure. But I do know something else. What do I know? What fact is true? Yeah?

**AUDIENCE:** [INAUDIBLE]

**PROFESSOR:** What's that?

**AUDIENCE:** It's more accessible.

**PROFESSOR:** Well, it's more accessible. We're flying more routes, but they're shitty. How do. I know people wouldn't rather do something else? Yeah?

**AUDIENCE:** You can still pay for a better experience. So the fact that people are buying a cheaper ticket.

**PROFESSOR:** Yeah. Because we haven't ruled out high quality, high prices. Just no one wants it. OK? So people who bitch about oh, flying is terrible. They don't bitch about the fact that it's really cheap. And if you don't like that, fly business class. Or if you don't like that, get together and form an airline that gives the old, high quality, high prices.

JetBlue sort of tried to do this. JetBlue was kind of a better experience. Now, they've deteriorated back towards what other airlines are. When JetBlue started, you got all these free snacks and stuff, which no one was doing. They were trying to do that a little bit.

But the bottom line is, if you want to tell me, gee, the old world was better, I tell you, fine. Go back to the old world. If it was better, it should exist. It doesn't. Because while people don't want-- people may bitch about flying now, they aren't bitching about the prices. And we're happier.

And this is the key concept, once again, of revealed preference. This is how economists test welfare conclusions. We use revealed preference. We've revealed that we'd rather have low quality at low prices because it's rewarded in the market. New, low-cost airlines that suck enter all the time, but high-end airlines don't. So we want low quality at low prices. And we'd all rather have high quality at low prices, but that's not an option. OK? That's the third thing that happened.

The fourth thing that happened-- actually, five things happened. The fourth thing that happened is that safety, the other thing you'd be concerned about is, well, gee, now there's no incentive to be safe. But in fact, it turns out safety didn't change. It turns out there's still enough incentive to be safe, that it wasn't like, the regulation was actually making flying any safer. Flying is unbelievably safe. It always was. It always is.

So this is all great news. Economists for the win. Except, economists got one thing wrong. We got one thing wrong, which we missed the fact that while there's not huge barriers to entry in terms of airplanes, there is huge barriers to entry in terms of what? What's the barrier to entry? Yeah? Airport slots. Those are fixed. And that it's incredibly hard to expand an airport. Logan Airport, until about 12 years ago, had one runway at night-- one runway in Boston at night. Think about that, for the city of Boston.

We expanded it to two. It took 25 years to happen, to expand to two runways. It is very hard to add new airport slots. As a result, there is a truly fixed barrier, which is airline slots. And as a result, competition did not go up as much as we thought.

Take Minnesota, where I had to fly for years to visit my wife's family. Minnesota was served almost as a monopoly by what was called Northwest Airlines. They're now part of Delta. Now, why didn't the city of Minneapolis and Northwest control all the slots at the airport? Why did the city of Minneapolis say, hey, Northwest, we're going to take away a few of your slots and allow another airline to come in and create some competition? Why? Because Northwest Airlines was headquartered in Minneapolis, and they said, if you that, we'll leave, and we'll take all our jobs with us.

And so essentially, the city of the city of Minneapolis barely let any competition in. As a result of this ability to monopolize slots, airlines set up what we call the hub and spoke system, which is, if you want to fly from A to B, you got to, on the way, stop at C, which is their headquarters airport. So airlines funneled all their traffic through airports where they're monopolies. And as a result, while there's much more competition-- prices did come down a third-- there's much less than we thought there would be because we missed the fact that the airport slots are truly fixed and aren't expanding.

So this is a great lesson in the power of economics. But even creative economists, a lot of us can't see the future. Industry is incredibly creative at maximizing its profits, and that they will come up with things to get around almost any well-meaning government intervention. Doesn't mean government interventions aren't a good thing to do. It doesn't mean we can't do more, but it does mean we have to consider, we think about projecting the effects of government interventions, how industry will respond what we call the dynamics.

We can't just say this is the way the industry works today, so it'll always work that way. We have to consider, well, what are the other angles? How is the industry going to respond? And that's, once again, a big challenge for government policymakers is envisioning the world as it might be under your regulatory environment, not as it is today.