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JONATHAN GRUBER: Today we're going to continue our application of what we've learned so far. And today we are going to really dive in, in some sense, what we could consider the mother of all market failures, which is externalities. The classic, the single most classic example that economists use when they talk about market failure is externalities.

And today we're going to talk about externalities-- what they are, why they represent market failures, and what governments can do about them. So an externality exists whenever the actions of one party make another party better or worse off, but the first party doesn't get the benefits or consequences of doing so.

So do my actions make you better or worse? But none of the benefits of making you better, or the cost of making you worse accrue to me individually. In that context, that's an externality. And we will talk about why this is a fundamental source of market failure. And we're going to talk about four different types of externalities.

So we're going to start with the most classic case, which is a negative production externality. This is the most classic example of externalities. So suppose that there's a steel plant located on a river. How many guys read *The Lorax?* You guys-- oh, excellent. Good job! Doctor Seuss, second-greatest author of history behind Shakespeare is Doctor Seuss. OK, so *The Lorax* tells the story of this plant dumping crap into the river.

Well, think about *The Lorax.* Think about a steel plant in a river, dumping sludge into the river. It's a natural byproduct of the steel. They're not making thneeds, he's making steel. Natural byproduct of the steel plant is this sludge. And every unit of steel that's made produces one unit of sludge that gets dumped by a pipe out the back into the river, just like in *The Lorax.*

However, the steel plant is not the only user of this river. Farther downstream from the steel plant is a set of fishermen. And they fish in this river, and they make their living fishing in this river. And it turns out that the sludge that the steel plant is dumping in is killing the fish and hurting the livelihood of the fishermen down the river.

Now, this is a classic negative production externality. It's negative because my action as a steel plant affects another party, which is the fishermen. It's production because it's a byproduct of the production process. We'll talk later about consumption externalities. You'll see the difference. And so this is a classic negative production externality.

And the way we analyze that is shown in figure 24-1, once again, from my textbook. We think about the market for steel. The standard market diagram, you've got the quantity of steel on the x-axis. You've got the price of steel on the y-axis. You've got a demand for steel, which is the blue downward sloping line, and the supply of steel.

Now the key distinction we're going to make here that we haven't drawn before is when we've talked about what demand and supply represent, we've talked about them as private concepts. The demand curve is individuals' willingness to pay. The supply curve is an individual firm's willingness to supply.

But implicit in that-- and implicit in the welfare analysis we did way back in lecture 12-- is the notion they also represent social curves. Implicit in all the analysis we've done is the assumption that the aggregation of individuals represents society. And therefore, what's best for individuals is best for society.

So implicit in what we've done is that private benefits equals social benefits. So the demand curve, for example, the slope of the demand curve is the private marginal benefit of another unit of steel. It's also the social marginal benefit. Now we haven't raised this before because it didn't matter before. But today, it will.

Likewise, the supply curve is the private marginal cost of producing another unit of steel. We just called it marginal cost. We didn't call it private, but that's what it is. And we also represent that as the social marginal cost of producing steel. It's what it costs society to produce steel is what it costs the producer.

The difference with an externality is social costs now deviate from private costs. So if you think about what is the cost of producing a unit of steel, well, there's the marginal cost of that steel-- all the stuff that goes into it. Plus there's the fact that every unit of steel creates a unit of sludge, and that kills fish.

Now, that is not a private cost. The steel plant owner couldn't give a shit. It's a social cost. But society is worse off because the fish are dying. Society is comprised of everyone in society. So the cost of producing steel, the social cost, is now the manufacturer's private marginal cost, plus the marginal damage.

So the social marginal cost is the manufacturer's private marginal cost, plus the marginal damage that that production does to society. In this case, society is represented just by the fishermen. You have the rest of society. We are going to assume, to make life easy, that marginal damage is constant. You can imagine upward or downward sloping marginal demand curves. Let's leave that alone. That makes it harder.

All the math and all the intuition goes through. We'll assume a constant. Assume that every single unit of sludge dumped causes a constant marginal damage-- MD-- in terms of killing fish. What does that imply for both private and social welfare? So for private welfare, for what the market delivers-- this is otherwise a perfectly competitive market-- it delivers the outcome at point A.

The perfectly competitive market delivers the outcome of point A. With no externalities, that is also the socially optimal outcome. We covered that. That's the first fundamental theorem. But now we say no, the social cost is not the blue line, it's the red line. It's the private marginal cost plus the marginal damage, which is a shift upwards. It's a constant shift upwards because we're assuming marginal damage is constant.

So the social optimum is not at A, it's at C. In other words, from society's perspective, the steel company overproduces steel. Why does it overproduce steel? Because the steel company is saying, I'm going to produce steel until the cost to me equals the benefits to consumers. But from society's perspective, you should produce steel until the cost to society equals the benefits to society.

The benefit to society is the demand curve. But the cost to society is supply curve plus the marginal damage. As a result, the steel plant is overproducing steel because it's not accounting for the externality. It's not accounting for the damage done to the other party. And as a result, we get overproduction of steel and a deadweight loss.

The deadweight loss is a new concept because we haven't had private and social cost deviating before. We've seen deadweight losses before. But this is a new kind of deadweight loss that arises because the fact that the steel kills fish creates an externality which causes the steel producer to overproduce steel. And as a result of that excess production of steel, we get a deadweight loss.

Deadweight losses-- here's the trick-- are done relative to social marginal cost. The ultimate goal is to have social welfare maximization. That's at C, not at A. So you've created a deadweight loss. Questions? It's a little mind blowing, different concept. Question about how this works? Yeah.

AUDIENCE: So does society have demand steel at point C or not?

JONATHAN GRUBER: No. See, the thing is, society-- well, it depends. Define society. The market can only operate as the market. The market is the market for steel. That's what I've drawn here. Society, being the government, could decide to address this, and we'll talk about later. But the market itself leads to point A. So the market's leading us to overproduce steel.

This is not a positive analysis. The positive analysis we already know how to do. Positive analysis, you get to point A. This is a normative analysis, which is point A is overproduction. We're producing too much because they're not accounting for the damage done to the fishermen. Let's drill this intuition home by talking about another case. Let's talk about a negative consumption externality.

Let's talk about a negative consumption externality, the classic example of which is smoking. When I smoke, I exert a negative effect on society, partly because I raise the cost of medical care for dealing with me when I'm old, partly because I create secondhand smoke. But for lots of reasons, my smoking creates extra costs for society.

So my smoking decision is represented in figure 24-2, the cost of producing cigarettes. We're assuming no production externality here. So the supply curve is both the private marginal cost and the social marginal cost. There's no production externality. But I choose to smoke at point A-- or the market chooses smoking at point A-- which is where the private marginal cost equals the private marginal benefit.

However, the social marginal benefit is lower than the private marginal benefit. The social marginal benefit is equal to the private marginal benefit minus the marginal damage-- which, once again, I assume is constant-- done by my smoking. In other words, I over-smoke. Because when I decide to smoke, I just compare my benefits to the cost of cigarettes.

I don't consider the fact that I'm making you sick and making your tax dollars go up by my smoking. As a result, I smoke too much, from society's perspective. Think of society as the bubble that includes everyone. Whereas my decision is a bubble that just includes me. So I'm only deciding based on me. I'm ignoring the rest of that bubble. If my decisions affect the rest of that bubble, then I'm overconsuming.

And therefore, we get too many cigarettes consumed and a parallel deadweight loss. This time it comes from a shift in the demand curve. So that is another example. You note here we used a number. We use $0.40. That's the best estimate. $0.40 or $0.50 is the best estimate of what the negative externality is from smoking, about $0.40 to $0.50 a pack.

If you add up all the costs smokers impose on society, it's $0.40 to $0.50 a pack. And that's why we use that as a constant marginal damage here. So given this, there's over consumption of cigarettes. Externalities can also be positive. We can have a positive production externality. The classic example of that, let's think about what we're-- now you are in the concept. Think about what I'm going to talk about here.

I'm going to talk about something that firms do that has benefits on others that the firms don't realize. What's a classic example of that? Research and development. When a firm does R&D, it creates new science, which benefits consumers. But consumers pay for that. But other firms learn and go further up the development curve based on what the first firm did.

So if you think about-- if you go to figure 23-4, think about the market for R&D. When a firm is deciding how much R&D to do, it considers what's the cost of R&D. R&D is a cost. You got to hire scientists and build labs and shit. So that's the private marginal cost. And there's a benefit for R&D, which is how many patents does it deliver for the firm. That's going to drive the demand.

What the firm is ignoring is that by doing R&D, they are actually producing knowledge that cannot be held totally privately. Eventually, when the patent runs out, it's public. Or even before that, firms may learn. And that's going to benefit other firms. That's going to lower the cost of development for other firms. So there's a social marginal benefit, which effectively lowers the marginal cost of R&D.

From society's perspective, when firms do R&D, it's more valuable than the firm itself sees. Indeed, the best estimates are that the private rate of return to firms is on the order of about 15% to 20%-- pretty high rate of return, because it's a risky investment. The social rate of return, which is accounting for the benefits other firms get from that R&D, are something like two to three times as large.

Because of all the benefits to society, when one firm does it, it, spills over and other firms benefit, as well. So that is a positive production externality. As a result, firms do too little R&D. Just like a negative production externality causes the steel plants to produce too much steel, a positive production externality causes firms to do too little R&D.

That's one reason why in the US we have a tax credit to promote R&D. Finally, we have the last example, which is a positive consumption externality. And here, let me move away from the graphs and talk about an example. I have a neighbor who I'm not fond of. I may have mentioned this before. I do not like my neighbor.

Part of the reason I do not like my neighbor is my neighbor has a tendency to do big projects about halfway and then stop because he gets bored. One such project he started about 20 years ago. He decided to do a massive landscaping job on his yard. And as part of that job, he produced a giant mound of dirt that was directly out the window of our kitchen.

And then he stopped. And that dirt has sat there for 20 years. Now at one point, my wife snuck out and planted wildflowers on it so it wouldn't look so bad. But the bottom line is, we got this pile of dirt this guy created. So let's think about his decision about whether to get rid of that pile of dirt.

Imagine that it would cost him $1,000 to get rid of that pile of dirt. And imagine, because he doesn't mind looking at dirt, it's only worth 800 bucks to him. So the marginal cost is $1,000. The marginal benefit privately is $800 if he won't get rid of it. But what if it's also worth another $500 to me? Well, in that case, the social marginal benefit is $1,300, which is above the cost. So he should remove the dirt.

But he won't because he's a jerk. And he doesn't care what I think. He's just his own-- and look, he won't not do it not just because he's a jerk, but because he's considering his own, private, marginal cost of benefits. It's not worth it. Because it's an x-- because removing it would have a positive effect on me. And he's not accounting for that. So he is under-using landscaping. Questions about any of this? Yeah.

AUDIENCE: What's the difference between [INAUDIBLE]?

JONATHAN GRUBER: They're just two totally different market failures. We could discuss that more another time, but they're really not related in fundamental ways. I mean, in some sense, you could think of information asymmetry as creating things that look like externalities. But they're just two different ways the market can fail.

But my neighbor example raises a really interesting question. I now hopefully have convinced you externalities exist. They're real. They cause inefficiencies. But do we need the government to fix them? I mean, after all, I could go to my neighbor and offer him 500 bucks to do the landscaping, right? We don't need a government.

Indeed, there's a very famous lawyer and economist named Ronald Coase who posed what we call of the Coasean solution of externalities, which is just, negotiate. Basically, this fisherman could say, hey, you're doing this damage to our fishing. Let's negotiate and have you produce less steel. Basically, the idea is, we don't really necessarily need a government with Coase's argument because we can solve through negotiation.

In practice, he's wrong. And he's wrong for a number of reasons. The first reason he's wrong is that the most important externalities are not things like me and my neighbor. They're things like global warming. Global warming is the ultimate externality. When you drove your car last, you were ever so incrementally putting Bangladesh under water-- even if it's an EV. Less if it's an EV, but even still.

Did you think about that? Did you think, well, I'm going to drive-- you thought about my drive, is it worth it? Did you think, oh, but also I'm putting Bangladesh under water. No, you didn't. Because that's an externality. You're not accounting for that. The problem is, that's an externality that's created every day by billions of people and affects billions of people.

How would they negotiate? How would the billions of people who create carbon get to the billions of people who are affected by carbon and negotiate? They can't. It's implausible. So one problem with Coase is it's simply implausible for the most important externalities, which involve many parties on both sides. That's the first problem with saying we can have a private solution to this.

The second problem is that it's kind of socially awkward. I mean, you'll notice I haven't, in 20 years, gone to my neighbor and offered him $500 to get rid of the dirt pile. It's kind of socially awkward. It'd be kind of a super bizarre thing to do, right? There's a famous story of an economist who was on a plane. Back before we had phones, we used to talk to people on planes.

And he was on a plane trying to get some reading done. And the guy next to him wouldn't stop talking, so he offered him $10 to shut up. Now we laugh because in reality, that can't be right. No one would do that. It's just because it's not how we really interact in society. So there's both negotiating barriers and norms that get in the way.

Think about a classic negative consumption externality is when your neighbor in the dorm room next to you plays their music too loud. That is a consumption externality. They are choosing the volume which optimizes the music experience for them. The benefits and costs, they're weighing off. They're not accounting for the fact it's making it harder for you to study.

Now do you ever go to your neighbor and say, look, I've calculated that this louder music will cause me to do 5 points worse on my test, which will affect my lifetime earnings by this amount. Pay me this or turn down the music. No! You either ignore it or tell them to stop it. You go over there and tell them to shut it off. We don't do Coasean negotiations in reality.

And as a result, this is why we need to bring in government solutions. The government needs to step in and solve the problem of externalities. Now, how can the government solve this problem? Well, one easy example is they can just regulate. They can just regulate. If the government knows what the socially optimal level of production is, it can just impose it. So for example, let's go back to our steel plant example.

Let's go back to figure 24-1. What if the government just came in and said, you know what? Steel plants, you're producing Q2. That's a socially optimal amount. Then boom, problem solved. We've produced a socially optimal amount. The government, through regulation, has enforced the social optimum. So that would be the theoretically easiest case.

The problem in practice is to determine what Q2 is, you need to know a lot. You need to know what the demand curve looks like. You need to know what the supply curve looks like. And you need to know the size of the marginal damage. Those are three hard things to learn. And in particular, we've talked before in the context of regulation about why it's very hard to measure these curves in practice.

The firms will lie to you about what the marginal cost is. It's hard to measure it. It's hard to get consumers to actually reveal what stuff's worth to them. For all the reasons we talked about, it's very hard to actually, in practice, measure these curves. So there's a lot of information you need to gather to get that right.

But what if there was a simpler solution? What if the government said, look, I do know the marginal damage, but I don't know what demand and supply curves look like. In fact, you don't need to know that. Because what the government can do-- like I said, it can regulate, which is easy in theory, hard in practice. The other thing it can do is corrective taxation.

Imagine if the government went to the steel plant and said, I am going to levy a tax of the amount MD on every unit you produce. All I know is MD. I don't know anything else. And this only works if MD is constant. But let's say I know MD is constant. Then I can go to the steel plant and say, I'm going to levy a taxing of MD. What would that do to the steel producers' decision?

Well, let's go to figure 24-4. The steel producer, the former [INAUDIBLE] was at A. Now the government is coming along and saying, I'm going to levy a tax on every unit you produce, a marginal tax of MD. Well, that raises their marginal cost by the amount MD, therefore, shifting their private marginal cost curve up to the point where it equals the social marginal cost curve.

What the government does through corrective taxation is cause the firm to internalize the externality. By basically pricing the externality, it causes the firm to incorporate that into their decisions, thereby doing so, getting to the socially optimal outcome. So the government can essentially solve this problem with fairly limited information. As long as it knows what MD is, it can solve this.

So for example, one of my former colleagues, Michael Greenstone, served in the Obama administration. And his main goal there was to measure what he called the social cost of carbon, which was, what is the marginal cost of what each unit of carbon does in terms of damage through global warming? Obviously incredibly hard calculation, but we have lots of engineering models about how carbon affects the environment.

And he computed the social cost of carbon. This is incredibly important because this became a basis for thinking about how we can tax the use of carbon. If Greenstone's calculations were right-- he came up at the time, it was about $50 per ton of carbon. $50 per ton of carbon is something like-- I forget, it's something like $0.25 a gallon of gas. Maybe it's closer to $0.50. I don't remember exactly.

We could just say, look, that's the tax. Every time you use carbon, you're going to pay this tax that's a social cost. And we would cause people to internalize the externality. We could address global warming with one calculation. That one calculation is simply, what is the damage the margin of carbon does to the world-- to the US or the world, we have to decide what we're optimizing. And then we're done.

Incredibly powerful, if you think about it. And this is the beauty of corrective taxation. Note that what you have here is-- let's go back to last lecture. Last lecture, we talked about the deadweight loss of taxation. We talked about how taxes create deadweight loss because they reduce the quantity produced. Trades that are productive are not made.

Here we're saying, a tax gets rid of a deadweight loss. It's exactly the opposite. Why? Because the trades it's getting rid of are not socially valuable. When you have a negative externality, there are socially invaluable trades being made. All the units consumed between Q1 and Q2 are losers for society. So if you go back to figure 24-1, everything to the right of Q2 has a social marginal cost above its social marginal benefit-- those units which are hurting society.

So by taxing the firm, we are bringing them to the socially optimal outcome. So taxes can create deadweight loss. Taxes can also get rid of deadweight loss. It depends on your starting point. If your starting point is already the socially optimal outcome, then taxes create deadweight loss. But if you're starting from a point of maybe too much production, taxes can reduce deadweight loss.

And that's kind of how we think about it. OK? Questions about that. Now let's talk about government policy in practice. Let's talk about what the government does in practice. Because this is one of the most important things the government does, is regulate and address externalities. And let's talk about the two biggest sources of negative externalities that we have.

The first is environmental externalities, and of course, as I said, the mother of all externalities, which is global warming. This is it. This is the most important externality that exists. It's an existential threat to life on earth. And it is a classic externality because our use of carbon, our little use of carbon, is creating damage to the entire future of the world. So it's a classic externality.

When I drive my car, I don't acknowledge the damage that's being done. And we all know how terrible global warming is. I don't have to give you the scary facts. Carbon dioxide in the atmosphere is now at its highest level in 400,000 years. Temperatures have risen by more than 1 degree Fahrenheit in the last 70 years, which is the most rapid increase in the last 1,000 years.

What you might not know is how bad it's going to be. Basically, scientists predict that by the end of the century, 20% to 40% of Bangladesh will be underwater. Cape Cod will be gone. Much of Florida will be gone. And the economic damage to societies on the order of $10 trillion, in terms of economic damage. Indeed, the world as a whole will be about 10% poorer by 2100 through the physical damage done by global warming.

So what could the government do? Well, I just described an easy answer-- corrective taxation. We use engineering models to compute the social cost of carbon, like Greenstone had us do. And we say, OK, we're going to put that into a tax. We'll basically compute for every carbon producing activity how much carbon it produces, and we'll tax it accordingly.

Indeed, Europe does this a lot. If you've ever driven in Europe, gas, even at today's high prices, is about twice as expensive in Europe, about twice as much per gallon of gas in Europe. It's misleading if you see the signs, because it's done by liter and you've got to convert. But it's basically about twice as expensive.

Why? Because of taxes. Because European nations significantly tax gasoline. We tax gasoline, but at a much, much lower level. They have much higher taxes. So the easy answer is, let's just tax gas here. The problem is political. Bill Clinton, who was president, had a lot of controversies during his presidency. One that has isn't talked about a lot is he proposed a $0.30 per gallon tax on gasoline.

And that was one of the most consequentially negative things he ever did for his electoral prospects. A lot of the reason the Republicans took Congress in 1994 was because of Bill Clinton's $0.30 a gallon gas tax proposal. So basically, we know the right answer, the answer economists have pushed for 50-plus years, which is a carbon tax.

But politically, it's been challenging. Therefore, the framework that's been adopted since 1992 is instead quantity regulation, and in particular, a cap and trade system for regulating carbon. What that means is we're going to limit-- each company is going to limit how much carbon it produces. That's the cap part. It's a regulatory target.

But we're going to allow countries to trade to take advantage of efficient opportunities. Let me explain what this means. So basically in the US, it is very expensive to convert to clean energy. And the reason is because we've built an entire economy around dirty energy. Think of a simple example. If I want a natural gas plant, I got to first tear down the coal plant or retrofit the coal plant to get the natural gas plant.

If you take China, they're building new plants rapidly. Well, it's not that much more expensive to build a natural gas plant than a coal plant. So for them, it's cheap to convert from coal to natural gas because they're going to build a plant anyway. They don't have to tear something down. It's a very crude description of why it's cheaper.

But roughly speaking, it is cheaper for developing countries to grow in a more environmentally sensitive way than it is for us to retrofit our economy. Now that's great. But if you go to these countries, and say that, they're like-- you! You guys got to party. You put all this carbon in the air. Now you want us to fix it? No way.

We get to have air conditioning. We get to have refrigerators. All the stuff you guys benefited from for all these years, now we're going to get it. So the challenge is, the quantity idea makes sense. But the problem is, how do you get the world to buy in? And the way you get the world to buy in is through trading. The idea here is, let's have permits of how much carbon can be polluted, and let's make those permits tradable.

So the US can say to China, look, it's very expensive for us to reduce carbon. It's less expensive for you. So what I'm going to do is I'm going to buy from you your clean production. I'm going to essentially pay you off to the reduction that I would otherwise have to do. So, in other words, instead of inefficiently, the US reducing pollution a lot and China, not much, we're going to more efficiently have the US send China a bunch of money and have China do the pollution reduction.

And it's the same outcome because it's global warming. A unit of carbon in the air doesn't matter where it came from. We are totally indifferent worldwide where carbon comes from. So if we have someone who can produce it more efficiently and someone who can produce it less efficiently, it makes sense for the less efficient guy to bribe the more efficient guy. And that's how we get this system to work.

Now this is a brilliant insight that economists, once again, [INAUDIBLE] economists pioneered. For many years, environmentalists were against this. They've adopted it. And this is how we try to regulate carbon. Now the problem is, it's still politically enormously challenging. Because ultimately, the cost of using carbon has to, one way or another, go up.

We will never really solve the problem of global warming until we make the costs of carbon feature the damage they're doing. The Biden administration took a somewhat different tack to this. They said, look, economists for years have been saying tax carbon, regulate carbon. Politically, we're getting nowhere. Here's a different idea. Let's subsidize green energy.

Remember, the opposite of a tax is subsidy. So instead of trying to tax the bad stuff, let's subsidize the good stuff. And the Inflation Reduction Act, which was passed last year, has hundreds of billions of dollars for subsidies, things like a $7,500 tax credit if you buy a US-made electric vehicle, subsidies for discovering new sources of green energy, for carbon capture, for hydrogen development, et cetera.

Basically saying, look, politically it's a lot easier to spend money than to tax money. So let's spend money to try to jump start a green economy that can move forward. Politically, it was brilliant. Practically, it's still not enough. Ultimately, if we're going to truly, as a world, address global warming, we're going to have to make people face the true price for what they're doing, which is to make carbon more expensive.

Questions about that? All right. Let's talk about the other big topic, the other big source of negative externalities, which is negative health externalities. There's a class of goods that are sometimes called sin goods-- smoking, drinking, driving-- because it causes global warming-- other drugs. And much of the consumption that we do of these sin goods imposes negative externalities on others.

So for smoking, I already mentioned there's higher medical costs. We spend about $80 billion a year in medical costs due to smoking-related illness. There's secondhand smoke. There's fires. Thousands of people die every year in fires started by smokers, et cetera. For drinking, there's drunk driving. We have 13,000 deaths a year and 400,000 injuries a year due to drunk driving.

Classic externality-- when I decided to get behind the wheel, I'm weighing the benefits and costs of driving drunk. I'm not accounting for the fact that I might ruin your life or ruin your family's life. We have gasoline-- we talked about that-- and other drugs. Indeed, drug overdose deaths are now the largest cause of accidental death in the US, about 100,000 people a year.

Here's the tricky thing. When are things externalities is not obvious. Because remember the definition. It's when my actions affect you, but I don't bear the consequence. Think about drunk driving. I do bear the consequences of getting caught. So is that really an externality? Because I bear the consequences.

Or let's take the interesting case of smoking. Imagine that someone sat by themselves on a rock in a non-flammable part of the world and smoked themselves to death. Would there be externalities from that? No. Or imagine that I smoke and it does ultimately raise my medical costs, but my insurers charge me more. Indeed, for the first time in history, the Affordable Care Act, which I'll talk about in the last lecture, allowed insurers to charge smokers more for their health insurance.

Well, if the amount I pay in extra premiums is equal to the damage I'm doing by smoking, then there's no more externality. I've internalized it. So externalities only arise when they're not internalized. That's a very important feature to think about. So the key is that people don't bear the costs. Let's talk about secondhand smoke.

The way secondhand smoke works, I smoke, you all cough. Let's imagine the way secondhand smoke worked was I took my cigarette and stabbed you in the arm with it. Let's imagine secondhand smoke worked by taking my cigarette and stabbing. That's the only way secondhand smoke could affect you. Would that be an externality? Maybe not, because you could punch me. You could sue me.

You could make me bear the cost of that secondhand smoke. Why is secondhand smoke an externality? Because no one owns the air. So you can't sue me for smoking in the air unless there's a law that says I can't. So externalities arise when there's not an individual remediation that can make the person bear the cost-- an important distinction.

When we think about consumption of sin goods, the government has a wide variety of tools it can try to use to address the externalities. So what are the government tools? One tool is information. The government can tell people, hey, what you're doing is really bad. Indeed, for smoking, information has played a huge role in the US.

In the 1950s, half of all Americans smoked. Half of all Americans smoked. And of all education groups, smoking rate was pretty equal across the entire distribution of income. Then we started realizing smoking was bad for you. In about 1980, smoking started to fall. But here's what's fascinating. It fell differently by education group.

Smoking among the highly educated has virtually disappeared. Smoking among the less educated continues to be lower, but still consequential. Still about 18% of Americans smoke. The limitation of information only works if people process it and use it and account for it in their decisions. So the information solution has created just more inequality in who smokes in America. So that's one solution.

The other solution is taxes. We can basically try to get smokers to internalize the externality by taxing them. And now that only works, of course, if people respond to taxes by smoking less. And it turns out, they do. It turns out people are somewhat price sensitive to cigarette price. The estimated elasticity is about minus 0.4-- that for every 10% you raise cigarette prices, people smoke about 4% less.

So one way to address those are taxes. Indeed, smoking's declined enormously. It declined slowly starting in the 1980s due to information. It picked up rapidly after 2000 due to a massive increase in taxes on cigarettes is a lot of what drove the decline in smoking in the US from 50% to 18%. And that's great.

But while that's an easy answer for cigarettes, it's much harder for other externalities. Take drinking. The first couple of drinks might actually be good for you. We don't know. But certainly many, many people think-- every cigarette you smoke is bad for you. There's no such thing as cigarettes are good for you or a harmless cigarette. Every cigarette is bad.

Whereas drinks, much of drinking is not harmful to you. Indeed, if you look at the big source of externalities of drinking, the biggest source of externality is drunk driving. Well, most of us will drink successfully in our lives without driving drunk. So if I deal with alcohol by taxing it, it's a little bit harder. Because what I'm doing is I'm collecting a lot of the revenues from people who won't cause the damage.

So that's a harder issue to deal with politically. That's a little more challenging. Think about the number one health externality facing our society in the next century-- obesity. One in every three babies born in America today will have diabetes before they die-- one in three-- because of the obesity crisis.

More than 35% of Americans are obese. Once again, huge inequality. I don't think I've taught an obese student at MIT in 10 years. But 35% of people your age or 30% of people your age are obese. So there's a huge amount of inequality in that. The trick is, addressing that through taxation is hard. Because we all know eating is actually pretty good for you. You got to eat.

So addressing obesity through taxation is really hard. We can't just tax food. That's going to really hurt poor people. So that becomes a place where it's even harder to address through taxation. A third solution we can do is penalties-- for example, losing your license if you drive drunk. That's great because that targets the people who are causing the externality.

If you guys drink a little and you're fine, you're not causing the externality. So this targets the person causing the externality. The problem is, it doesn't really help if penalties changing behavior relies on me making a rational decision to say, wow, I better not drunk drive because I'll get caught. When you're drunk, you're not exactly making rational decisions.

The problem with penalties is they don't work if the sin good itself is causing irrationality. A tax works because you just don't buy it in the first place. You say, wow, I can't afford that. A penalty doesn't work because it involves forward thinking of the type that might not being done while consuming these goods.

Finally, we have illegality. Illegality-- we could just say, look, it's illegal. And that's, in fact, what we do with hard drugs in this country, and in most states still with marijuana. We make it illegal. We say, look, there's these externalities, consume it. The problem with that is that is almost certainly not optimal. Because remember, even if there's externalities, unless those externalities are enormous or infinite, some people still derive benefits above the social cost.

Some people-- still, right now-- say cigarette taxes are close to optimal. But people still choose to smoke. Does that mean we should ban smoking? Not necessarily. It might mean that they just enjoy smoking so much they're willing to pay $8 a pack for cigarettes. So basically the question is whether you should ban an activity is going to depend very much on whether you think the externality is so large that it overcomes any possible benefit of consuming the good.

That's exactly the debate we're having-- oh, and there's one other thing. There's another wrinkle, which is, if you think about it, what is the largest source of externalities for illegal drugs? The crime associated with obtaining and distributing those drugs, which would not happen if they were legal. So not only might the externalities not be infinite, actually making the goods illegal creates externalities in a way that taxing them would not.

And this is the argument for why many people supported legalization of marijuana. Because basically the argument was, look, there's externalities of marijuana. People driving high still kill people. It's less bad than drunk driving. There's still some externalities, but they are not large enough to rule out the benefits some people get from consuming marijuana.

And we're creating new externalities by making it illegal-- all the money we're spending on police, all the money we spend on jails, all the damage that's done by enforcing those laws. And that was the argument for making marijuana legal. And that's the argument that's won in some states and not won in others.

You have to ask yourself, why does [INAUDIBLE] apply to marijuana and not cocaine or heroin? Well, if you really want to have a coherent argument, you've got to argue that the externalities from cocaine or heroin are so much larger than marijuana that we should allow marijuana to be legal and cocaine and heroin to not be legal.

And in fact, you'd be wrong. In fact, the externalities from these goods largely arrive from the illegality. And that is why most economists think all drugs should be legal. Not most economists, many economists think all drugs should be legal but taxed, that we should follow the model that we showed in figure 24-4. We should have corrective taxation account for the externality and not ban the good.

Now, I hope that discussion made you a little uncomfortable, as it does me. And the reason it made you uncomfortable is because the framework we're using embraces key assumptions that have been unstated this whole semester, assumptions like rationality. What we're going to do next time is ask how everything changes when we question those assumptions. And we're talking about behavioral economics.

But I wanted to leave you with this to remember, absent behavioral economics-- which we'll talk about next time-- it's really hard to justify making something illegal on something like externality grounds alone. All right, let's stop there. We'll come back next time to talk about behavioral economics.