14.01SC Principles of Microeconomics, Fall 2011
Transcript – Lecture 2: Applying Supply and Demand

PROFESSOR: Now, what we're going to do today is build on what you learned in section on Friday. On Friday, you learned about how supply and demand interact to yield equilibrium. So the sort of fundamental concepts we talked about with Adam Smith and his water-diamond paradox of supply and demand interacting to yield a market price and quantity.

And the way we're going to build on your understanding of this today is talk about what happens when you shock that supply and demand equilibrium. When things change, how does that change that supply and demand equilibrium? And that'll help build your understanding of what you learned.

So to review, let's go to our basic supply and demand graph, Figure 2-1 in the handout. You talked in section about the market for pork. That's the market Perloff uses. Seems good as any, so we'll continue to rely on that, the market for pork. And in this pork market, you have a demand curve and a supply curve.

Now, it's critical to remember what these curves represent. Once again, for this course, ideally, you understand all concepts on three levels, intuitively, graphically, and mathematically. But the intuitive is the most important, especially for those of you who aren't going to go on and do a whole lot of economics. For instance, where it's just one of the few economics courses you'll take, it's very important for your lives and using economics you understand this intuitively.

So intuitively, let's talk about what the demand curve represents. Can anyone tell me, what's the demand curve represent, from what you learned on Friday? Can anyone just take a shot? We're just-- yeah, go ahead.

AUDIENCE: The willingness of consumers to buy a certain product.

PROFESSOR: Exactly. The willingness of consumers-- I'm going to change your words just a bit, because words are important here. The willingness of consumers to pay. The willingness to pay. The difference with buy is it's really because the different amounts. They're going to be willing to pay different amounts.

So it's the willingness of consumers to pay for the good. The willingness of consumers to pay for the good. So what this says is that each point in the demand curve represents the price consumers are willing to pay for that quantity. And it's downward sloping. The demand curve is downward sloping because as the price goes up, consumers are willing to buy less of a good. So their willingness to pay changes.

So that's the demand curve. Now what about supply curve? What's a supply curve represent? Anyone? Yeah?

AUDIENCE: Pretty much the opposite. The willingness of producers to produce, like, how much they are going to charge for--

PROFESSOR: Yeah, the willingness of producers to supply the good. So how much they're going to charge for a given quantity of the good. And once again, that is upward sloping because as the price rises, they're willing to supply more. So as the price rises, consumers demand less. As the price rises, producers produce more.

And equilibrium is that point where supply equals demand. Equilibrium equals happiness. It's the point where suppliers and demanders are both happy. They're both happy because at a point such as e, the amount that consumers demand at that price is equal to the amount suppliers are willing to supply at that price.

So jointly happy. You've reached a point where consumers want a certain amount at a certain price. At that price, producers say, great, you want e, I'm happy to produce e at that price. So we've reached equilibrium.

Now, let's talk about what happens when we shock that equilibrium. This is the market for pork. Imagine that the price of beef rises. The price of beef rises. Can anyone give me a guess as to what that does to the market for pork? The price of beef rises. What does that do to the market for pork. Yeah.

AUDIENCE: It reduces the demand.

PROFESSOR: It what?

AUDIENCE: Reduces the demand.

PROFESSOR: Why would it reduce the demand for pork?

AUDIENCE: Because the price [INAUDIBLE].

PROFESSOR: But I didn't say the price of pork rises. The price of beef rises. And how does beef relate to pork?

AUDIENCE: They're substitutes.

PROFESSOR: They're substitutes. Exactly. So when the price of beef prices, how does that affect people's demand for pork? Increases it. Exactly. Because they're substitutes. What we're going to learn critically as we go through is what's going to determine these demand curves importantly is going to be substitutability across goods.

So here we have a situation where the substitute for pork has gotten more expensive. As a result, people want more pork. That is a shift out in the demand curve, or a shift up in the demand curve. A shift up or out, depending on it's out into space or up vertically in the demand curve.

So what happens here is that folks shift to consuming pork, so they want more of it. So we're initial equilibrium-- we just made up some numbers-- we're initial equilibrium here at 220 millions of kilograms of pork a year and a price of $3 a kilogram. That was the initial equilibrium. That was the point where demanders and suppliers were happy.

Now the price of beef has gone up, maybe because-- I don't know. Mad cow disease or something like that has raised the price of beef. So now people are saying, hey, we want more pork. That shifts the demand curve out. Initially, if the price stayed at $3, if the price remained at $3, what would happen? What would happen is people would now-- and once again, these numbers are made up. But this is just to illustrate an example.

People would now say, gee, at a price of $3 and this further out demand curve-- now I'm on Figure 2-2, if you haven't picked that up-- I want 232 millions of kilograms of pork a year-- not I, personally. That'd be like Homer. Everybody wants 232 millions of kilograms of pork a year. I hope you guys don't get tired of Simpsons references.

So what that says is consumers say, gee, I want a lot more pork at that price. If it's going to be $3, and the price of beef just went up, I'm going to want a lot more pork. So what you're going to have initially is excess demand, because at that price of $3, suppliers are only willing to supply 220 million kilograms. They were happy, right? They were happy at point e1. When you come along, and you say consumers now want more, they say, well, we're not happy to provide more at that price. If you want more, we're going to have to charge a higher price.

So they say, if you want more pork, we're going to have to produce more. So we are going to slide up the supply curve. So if you start at a point like e1, they say, gee, you want more pork? Well, we're going to have to slide up that supply curve. So we're moving up the supply curve and saying, we're going to have to charge you a higher price if you want more.

Well, as the price goes up, consumers say, well, wait a second. If the price is going up, I don't want quite as much more. And you meet at the new equilibrium e2. So what happens is producers say, gee, if you want more, I'm going to charge you a higher price.

Consumers say, well, gee, if you're charging a higher price, I'm going to go back up the demand curve. I don't quite want as much at that higher price. And the new equilibrium is e2. That's where consumers and producers are now happier with that outward shift in demand curve.

But the key point is consumers are not getting as much as they originally wanted at the original price, because the original price will not hold. The price is going to change. Given the price is going to change, the quantity is going to change. And you end up with both a higher price and a higher quantity for pork.

So think about it. This is pretty interesting. The price of beef rising raised the price of pork. It didn't just increase the demand for pork, but through increasing the demand, it raised the price. So price in one market affects the price in another market, not just the quantity but the price in another market. And that's our new equilibrium. That's the shift in the demand curve.

And once again, suppliers and demanders are happy. They're happy at this new point e2, this new equilibrium, because given the new demand curve, at a price of $3.50 a kilogram, producers are happy to produce the 228 million kilograms of pork a year that consumers want. And at that price, that's what consumers want.

If they're going to say, oh, it's $3.50, I want about 228. I want more than I wanted before, because beef's gotten more expensive, but not as much as I would have wanted if you hadn't increased your price. And that's the new equilibrium is e2. Yeah.

AUDIENCE: But is it possible that changing the price of pork could affect the price of beef?

PROFESSOR: Excellent. So the question is, could there be a feedback effect where, basically, now the pork market's changed, could that go back and affect the beef market? In principle, yes. In practice, we're going to make your life easy by saying no. In principle, it could. And that gets into something called "general equilibrium." And that's way too complicated for this course, so we are going to ignore those kinds of feedback effects for now. That's something you can learn about more in future courses.

But you're right. In principle, it could affect the demand for everything. You could imagine that as the price of beef goes up, that means that, for example, the cost of restaurant meals goes up. So I'm not

going to eat at the restaurant as much, so maybe I'll go to the movies more. So in principle, the price of beef going up could raise the demand for movies.

It's crazy. It's hard to know where to stop. So we're going to make your life easy by stopping at one level here. But you're right. In principle, there could be these wide range of feedbacks.

And once again, I talked in the first lecture about simplifying assumptions. We're going to try to teach you the basic concepts but try to make simplifying assumptions that make it more manageable. That's the kind of simplifying assumption we'll make for our modeling here in this course. So that's a shift in the demand curve. Yeah.

AUDIENCE: How do you quantify the shifts in the demand curve?

PROFESSOR: Excellent. And that will be exactly-- basically, the way we're going to learn in this course, we're going to do things a couple of times. When we talk about producer theory, we will teach you where this supply curve comes from. Basically, firm profit-maximizing decisions will determine the supply curve and how much it shifts, and we'll teach you that when we teach you producer theory.

So this is sort of a big overview. You're good MIT students. You're immediately thinking, where the hell do these demand and supply curves come from? That's where we're going to get to. That's the whole point of consumer theory will give us the demand curve. Producer theory will give us the supply curve. All right. Good questions.

So now, let's talk about a different case. Let's talk about a shift in the supply curve. So now, let's suppose there's a drought. And let's suppose it's a drought that only affects pork. Because if the drought affected beef, that would then have these other feedback effects.

Let's imagine there's a pork drought. I don't know what that would mean, but let's imagine that happened. So suddenly, it becomes more expensive-- or let's just say there's mad pig disease. Let's imagine there's mad pig disease. So suddenly, it becomes more expensive to produce pork. Because there's fewer pigs, it's more expensive to produce it.

So what that would do is that would cause a shift in in the supply curve-- inward or upward of the supply curve. Suddenly, on you get the fact that given that it's more expensive to produce pork, suppliers say, well gee, to produce a given amount of pork, I need to get paid a higher price. So we get, once again, initially, if the price stayed constant-- so now I'm on Figure 2-3. If the price stayed constant, we would not begin with excess demand. Because if the price stayed constant, then consumers would want 220 million kilograms of pork, which is what they wanted before.

Nothing's changed from their perspective. But producers would say, look, at that price, I can only now produce 205, because my supply curve shifted up. So once again, you have to move to a new equilibrium where suppliers and consumers are happy.

That will happen at a point like e2. Because at e2, given the higher price of producing pork, producers will now say, OK, I'm happy to sell 215 million kilograms at $3.55. And consumers will say, well gee, at $3.55, I don't want quite as much as I wanted before. I only want 215. And they're happy.

Here's what's striking. We had two very different phenomena. We had a demand shift and a supply shift. Both led to the same outcome. I'm sorry, both led to a higher price. Sorry, not the same outcome. Both led to a higher price. One led to higher demand, to higher quantity sold in the market.

So you go back to Figure 2-2. The price went up, and the quantity in the market went up from 220 to 228. In Figure 2-3, when the supply shift happened, the price also went up almost exactly the same amount. But here, the quantity fell.

So you can't tell from a price increase what happened. If the price of pork goes up, you can't tell me whether that was a demand or supply shift. You need to know both the price and quantity to be able to tell me that. Both changes led to the same outcome in terms of prices. Questions about that?

Now let's make it interesting. So we have the supply and demand equilibrium. Supply shifts, demand shifts, you move the points. You guys can all do it graphically, even if you don't quite get it intuitively yet. Now let's ask, what happens if the government comes in and messes this up?

Now, step aside to my other hat. The other course I teach is called Public Economics, which is all about the role of the government in the economy. In this course, most of what you'll learn is there's a clear

role of the government in the economy. It's to screw it up. Economics is fundamentally a right-wing science. Most of my colleagues are Democrats, but that doesn't change the fact that what we teach is fundamentally very conservative, which is the market knows best, and governments just mess things up.

Now, later in the semester, we'll talk about why that might not be true. And the whole point of my other course, 14.41, is to talk about why that might not be true and where governments can make things worse and better. But from your basic perspective, you need to be indoctrinated with this fundamental position, that the market gets it right. The market equilibrates. Governments mess things up. And that's sort of where we'll start.

So let's talk about the classic example of government messing things up, the minimum wage. You've all heard of the minimum wage, the thing workers get paid more. That seems like a good thing. Well, in fact, to economists, it's a bad thing. And let's talk about why.

To many economists, at least this initial analysis is a bad thing. We'll come back later as to why it might not be so bad. To do that, let's talk about equilibrium not in a market for goods, like pork, but in a market for inputs, which is labor. Labor is an input to the production process. We'll talk about this at great length later in the semester.

But the key thing is, just like there's a market for pork where the equilibrium outcome is the price you pay for pork and the amount of pork sold, there's a market for labor. And in that market, things are flipped. Who are the consumers now? Well, they're the firms. The firms demand labor. Who are suppliers now? Well, they're you. They're the people. People supply labor.

So now we've flipped things on its head. The suppliers are the people. The demanders are the firms. But the analysis is the same. This basic supply and demand framework, which will turn out to be so powerful this semester, can be used, even though we flipped the labels of who's on what side. So you see in Figure 2.4, we have a labor market with an upward-sloping supply curve.

What does that mean? Why is the supply curve upward-sloping? Because the higher your wage, the more you're willing to work. And we have a downward-sloping demand curve.

Why is it downward sloping? Because the higher the wage, the fewer workers the firm wants to hire. It would rather use machines instead.

So basically, you've got that same supply and demand curve, different stories as to where they come from, but the same effect in terms of determining equilibrium. We get an equilibrium at w1 l*, which is at a wage w1, l* workers are willing to work. Or l* hours are supplied of labor. We think about hours supplied, not necessarily number of workers. l* hours of labor are supplied.

And at that w1, l* workers are willing to provide l* hours, and at that w1, firms demand l* hours, and that's the equilibrium. Same analysis as before, just different stories as to what's behind the curve.

Now, let's say the government rolled in and set, as in Figure 2-5, a minimum wage. The government says, look, that wage w1 is too low-- or w* in this graph-- is too low. Workers are not paid enough in equilibrium. We need to make sure that they get paid a minimum amount. So we are going to mandate that workers cannot be paid below w lower bar, which is critically above w*.

Well, what happens in that case? Well, in that case, at that wage, workers are thrilled. They say, look at that wage. We are delighted to work-- god, the numbers are-- I'm getting old-- ls hours.

I have my prescription for my bifocals. I've had it for, like, two months, and I just can't quite take it to the mall and get them. So eventually I'll get them. I just can't quite admit I'm that old.

So workers are like, great. At that wage, we'll supply l sub s hours. That sounds great to us. We're all good. But the firm says, wait a second. No, we don't want to hire l sub s hours at that wage. That's way too high. We only want to hire at that high wage l sub d hours. So suddenly, here you have a case of excess supply. Not excess demand, excess supply. Workers want to supply more hours than firms want to hire.

Now, in our previous example, what would happen? What would happen is, if there's excess supply-- well, let me ask you. If there's excess supply in the market, how would the market equilibrate? What would happen? Yeah.

AUDIENCE: It would lower the price so that the--

PROFESSOR: In this case, the price is what?

AUDIENCE: The number of--

PROFESSOR: The wage. The wage. So exactly. In our previous example, the wage would fall. Workers would suck it up and get a lower wage. Firms would be happy to pay a lower wage. You'd reach a point where they were happy. You'd reach a point like e. But you can't now.

You can't, because the government said you can't pay less than w lower bar. So you end up with excess supply. And we call that excess supply "unemployment." You end up with unemployment, because at that high wage, firms are not willing to hire as many workers as are willing to work. And you end up in disequilibrium. You end up not in equilibrium but disequilibrium.

Now, disequilibrium is kind of hard to think about, because in some sense, this course is all about equilibrium. So I'm not talking about chaos or cats and dogs living together, breakdown of social order. That's not what I'm talking about. Disequilibrium, there is still a market outcome. The market still settles at a point.

In this case, what happens is the market settles at a wage of w lower bar because it has to and at an amount of labor delivered at l sub s, that low amount of labor delivered. Because when you're in disequilibrium, the outcome of quantity and prices is determined by the constrained party. That's the way I like to think about. You can think about it however you want.

But here's the point. Workers can't work if firms won't hire them. So if you want to say, look, we're going to end up at w lower bar, how much labor is going to be in the market? Well, it's up to the firms. They get to decide.

They're going to say, look, we don't want more than l sub d, so that's how many jobs they're going to provide. So the new outcome is going to be at a wage w lower bar and an amount of hours l sub d. So

basically, you end up with this unemployment situation where only l sub d workers are hired and the wage is w lower bar.

Now, let me ask a question. What would happen if w sub lower bar was set below w*? What if I'd redrawn this diagram so w lower bar was below w*? Yeah.

AUDIENCE: The market would equilibrate and--

PROFESSOR: Yeah, nothing would happen at the end of the day. And here's the key point-- very important point to remember-- which is that markets are very robust. Economic markets are very robust. And if they can undo the effective government intervention, they will. So if the government tries to come and intervene in a way which markets can undo and get back to where they wanted to be, they will.

That original point e is where the market wants to be. That was where it was happy. It can't get there in the example I taught here with w lower bar above w*. But if w lower bar was below w*, it could get there and be happy, so government intervention would make no difference. That's one example of a government intervention.

Let's do another example. Then I want to talk about the pros and cons of these government interventions. Let's do another example. Gas price ceilings. So let's consider a cap on how much can be charged for gas. Seems a pretty sensible policy. Gas is crazy expensive. We all like to drive. So let's consider a cap on the price of gas. Imagine, for example, we're initially in equilibrium, in Figure 2-6, with demand of Q2 and a price of P1. We're all happy.

Now let's imagine there's an oil crisis, because, say, oil companies decide it's a good idea to drill eight miles underground, and everything explodes, and we suddenly run out of oil. So all of a sudden, there's a constraint in the supply. Suddenly, there's a-- I'm sorry, my bad. We're initially in equilibrium at e1. My bad.

We're initially at equilibrium at e1, with a price of P1. There's a bit of mislabeling here. On the vertical axis, that upper price should be P2. So on the vertical axis, you see there's P1 equals P. Then above it, it says P1 again. That should say P2.

So we're initially in equilibrium at point e1 with a price of P1 and a quantity of Q1. Now oil tanks blow up all over the world. Suddenly, that means there's a restriction in the supply of gas. Suddenly, there's not as much gas as can be produced. So that's an upward shift in the supply curve, just like we talked about before.

And absent any government intervention, the supply curve would shift up to s2, consumers would want less gas, and you'd reach a new equilibrium at e2. And once again, let's talk about equilibrium as being where people are happy.

Now, you could say, well gee, people aren't happy paying a higher price for gas. Well, that's why I'm a bit glib using the term "happy." It's a point where the suppliers and demanders are jointly willing to make the deal. And they're willing to make the deal at e2. They're willing to say, look, given how many oil rigs have blown up, we are happy to equilibrate the market now at a higher price and a lower quantity.

But then it's September, 2010. There's an election two months away. President Obama isn't very happy about this. And he says, forget it. We're going to cap the price at P. We were paying P before. We can pay P again.

Those stupid oil companies can suck it up. They're the ones who drilled eight miles underground. They're the ones who blew everything up. They can suck it up. We're keeping the price at P. We'll help the consumer. We'll keep the price.

Well, what happens? What happens is that consumers are now, great, we continue to want Q1. That's where we were before. We're happy. But producers say, well, you know what, President, we can't supply that much at that price. Because it costs us so much to drill oil now that if you're going to force us to keep the price at P1, we are only going to supply Q sub D because we just can't supply at that low price. We're going to supply Q sub D.

So what happens, you end up with excess demand. Consumers want Q sub D gallons. Producers are willing to produce only Q sub S. And you end up with disequilibrium. And in this case, once again, the amount sold is what the producers are willing to sell. It doesn't matter how much consumers want if

producers aren't willing to sell it. You end up with disequilibrium, and you end up with much, much less gas being sold.

So yeah, the price stays low, but the amount of gas being sold is much lower than if the president allowed the price to rise. So that's another example of a government intervention causing disequilibrium. Any questions about that? Yeah.

AUDIENCE: In the last chapter, we talked about, can the government then come in and give a subsidy to the oil producers to produce the same amount?

PROFESSOR: Great. Hold that thought for 14.41. But that's exactly what the government could do. The government has lots of tools. So it can come in and say, well, on the one hand, we'll set a price cap. But then we'll come in on the other hand and give a subsidy to oil producers to make sure they do that.

That has two problems. One is, not so good with the voters. Like, gee, we're going to give subsidies to oil companies. Isn't that a great idea. Two is, you've got to raise the money somehow, which means you've got to raise taxes. Also not so good with the voters.

So it's, in general, not a good idea, because you screw it up on the one hand to screw up again. Two wrongs don't make a right, something I learned from an early age. If the government's messed up the market on the one hand, it's not, generally, a good idea to try to mess with it again to fix that. But that's exactly the kind of stuff we'll discuss in 14.41.

AUDIENCE: I've got a question about that. Will that mean that there's a [INAUDIBLE] because [INAUDIBLE]?

PROFESSOR: Great segue into what I want to talk about next, which is, what are the costs and benefits of these kinds of market interventions, of a minimum wage or gas price ceiling? Why do we do this? The government, these aren't stupid people, by and large. Why do governments do things like this? What are the costs and benefits?

Now, later in the semester, we'll talk about welfare economics. By welfare, welfare has two meanings. We often think of welfare as being money distributed to poor people. That's one meaning. But when we say "welfare economics," we actually mean the well-being of society. And we'll talk about the well-being of society later on in the semester.

But let's talk for a minute about this general topic. And how do we think about the kind of welfare economics of these restrictions? Well, there's two costs and one benefit to these restrictions. The first cost is the efficiency loss. So the costs of things like the minimum wage and gas price ceilings, the first cost is the efficiency loss.

And we are going to be much more precise. This lecture is sort of a chance to be loosey-goosey about things that I'll then make much more precise throughout the semester. We'll be precise about what we mean by this throughout the semester.

But the key point is, in economics, whenever there is a trade that can be made that makes both parties better off, and it is not made, that is an inefficiency. So in economics, we define "efficient" as when all trades that can make both parties better off are made. And whenever anything comes up that interferes-- so a trade that could make both parties better off is not made-- that is inefficient. There is an efficiency loss.

And think about it. It makes sense. If both parties could be better off by a trade and don't let it happen, then society is worse off. That's the idea of an efficiency loss in economics. Economics is all about trading to make things work more efficiently. When you don't let that happen, you've hurt society. You have a welfare loss, because you have something that could've made both people better off, that would've been a good thing to do. You haven't allowed that to happen.

And if we think about it, in both these examples, Figure 2-5 and 2-6, there are trades that would've made both parties better off that we're not allowing to happen. So in the labor market case, think about a wage that's above w* and below w lower bar. So a wage in that interval.

At that wage, workers would be happy-- and take unemployed workers. Unemployed workers would be happy to work it a wage somewhat below w bar. Firms would be happy to hire them at a wage somewhat below w lower bar. But it isn't happening, because the government has interfered. That's an efficiency loss.

Likewise, look at Figure 2-6. Consumers would be happy to pay a somewhat higher price and get some more gas. Producers would be happy to produce more at that higher price. But it's not happening. That's an efficiency loss. So an efficiency loss is whenever there are trades that can make both sides better off that don't happen.

Once again, this is loosey-goosey here. We'll make this all more precise as the semester goes on. But it's important to get the big picture concept of what we mean by efficiency in economics, which is trades being made that make both parties better off.

The second cost here is what we call "allocation inefficiency." Remember in the first lecture, I talked about how prices play three roles in the market. They determine what is to be produced, they determine how it is to be produced, and they determine who gets it. That's called "allocation." Price plays a critical role in making sure that the people who want the good the most get it.

Because remember, that demand curve is a willingness-to-pay curve, or a willingness-to-buy curve. What that lets us know is the further up the demand curve, the more people want the good. And we should make sure that those people are allocated that good.

So in a world of equilibrium, we make sure that the allocation happens. Anybody who wants the good at a price that consumers are willing to sell it gets it. Someone who doesn't want it at that price doesn't get it. Equilibrium takes care of that allocation problem.

But in disequilibrium, it doesn't. Let's consider the gasoline example. Now we have a case where there are many, many people-- in fact, all the folks who lie between Qs and Qd on that x-axis-- all those folks want gas at that low price but can't get it. There's only Qs being supplied. So what happens? Well, what happened-- you guys weren't alive for this, but in the 1970s, does anyone know what happened when we did price ceilings of this type? Does anyone know what happened?

AUDIENCE: Gas shortage.

PROFESSOR: Gas shortage. And how did people respond? How was gas allocated in that gas shortage?

AUDIENCE: There were lines.

PROFESSOR: Peopled waited in huge lines. Basically, we couldn't use the price mechanism, so what did we do? We used the wait mechanism, just like they used to do in Russia all the time and still do. The point is the gas that's limited-- that Qs-- has got to get allocated somehow. In the market, it gets allocated by the price rising until the price is high enough that the set of people who want it at that price get it. With this gas price ceiling, that can't happen.

So what happens? Lines for gas. Huge, hours-long wait. This is sort of inconceivable now. Sometimes, you have to wait at a gas pump, but pretty much, you drive up, you get your gas, you leave. In the 1970s, literally, you would wait hours-- multiple hours-- in line to get gas. That was how the gas was allocated in the face of these gas price ceilings. Yeah.

AUDIENCE: What about things like the government saying you can't shut off someone's gas in the winter, even if there was a price ceiling?

PROFESSOR: OK, let me come back to that. Hold that thought for a couple minutes. I want to come back to that. But I want to focus on these gas price lines and why they're bad. Well, these gas price lines are themselves a source of inefficiency. And why? Why is it inefficient to have people waiting in line for gas? Yeah.

AUDIENCE: Because they could be working or doing other things.

PROFESSOR: They could be working. They could be out making trades that make everybody better off. Instead of being in line waiting for gas, they could've been at work, working for a wage that they were happy to earn and their employer was happy to pay. So a trade is not being made. Unless they're equally happy sitting in line waiting for gas, which is doubtful, a trade is not being made, which makes both parties better off. What else?

AUDIENCE: I have a question. Did the government know about this?

PROFESSOR: Yeah, believe me, they did. But they said, well gee, we can't let people pay those high prices. Governments face really hard decisions like this all the time. There's another program, of course, which is, what happens with people waiting in line for gas? They're idling and using up gas. So in fact, there was a direct mechanical inefficiency as well, which is all the gas that was wasted while people idled in line, waiting to get their gas.

So that's the kind of inefficiency you're used to thinking about as engineers. There's a mechanical inefficiency, but the main thing we care about is the allocative inefficiency, which is trades are not being made because people are sitting in their cars waiting for gas. And that's inefficiency. And that inefficiency arises because we have to allocate the gas somehow.

You can't get around that problem. Remember, we are the dismal science. We point out problems that cannot be surmounted. You can't get around that problem. That gas has to get allocated somehow. And if you don't let the price mechanism allocate it, some other, more inefficient mechanism will arise to do so.

Now, the trade-off, of course, is then you keep the price low. And the government's got to decide-- once again, this gets into the political economy of how the governments make these decisions. And that's not really the point of this course. But that's the kind of decision they have to make. Now let's come-- and this will touch on your question-- oh, do you have a question about this?

AUDIENCE: I have a question, actually, about the minimum wage. So isn't it a little imbalanced, because when people need work more than companies need people-- because, for example, there are a lot of instances when companies are paying hunger wages, a dollar a day. [INAUDIBLE] they're not happy for it.

PROFESSOR: Yeah, basically, in some sense, the bottom line is, equilibrium is where people are going to work for what the company's willing to pay. Now, you can say, if people want work when the company wants to offer it, that's sort of a difficult subjective judgment. But at the end of the day, if people are willing to work for a dollar and the company's willing to hire them for a dollar, then that's a trade which should be made. Except, that's a great example to point out-- same person who just said that, well then, tell me what's the benefit of a minimum wage?

AUDIENCE: [INAUDIBLE]

PROFESSOR: It's equity, that thing economists like to not think about, because it's tricky. It's fairness. It's equity. It's unfair that you would work for a dollar a day. And people might be exploited and work for unfairly low wages. Likewise, it's unfair that we pay a huge amount for gas. So people, we should keep the wage high and the prices low to make it fair. And that's the pro of the minimum wage. Yeah.

AUDIENCE: I didn't quite get [INAUDIBLE] it is giving a few people a higher wage, right? But it's causing unemployment, so how is that better?

PROFESSOR: Wonderful point. Wonderful point. That's because in economics, there's the direct effect and the indirect effect. And the direct effect is what voters understand. And the indirect effect is what we understand. In the case of gas, it was easy to see. The question, why didn't the government realize this? Everyone saw the direct effect, which was low prices, and indirect effect, which was long lines.

With a minimum wage, it's harder, because there's lots of reasons for unemployment, not just the minimum wage. So the indirect effect is a lot harder to see. If you're a politician, you're saying, look, I'll raise the minimum wage. I'll make sure you're paid more. Everybody goes, yay. And then the economist says, well, you have to understand, according to this diagram, that would lead to unemployment. People are like, whatever. Shut up.

So basically, the point is that, basically, yes, you're right. But for perceived equity, this is the case. But you're right. There's a trade-off. Just like they recognize the trade between the price and the lines, there's a trade-off between the higher wage and the employment. And that comes so what we'll talk about, empirical economics, which is measuring that trade-off.

Well, how big is that trade-off? How much unemployment does a higher minimum wage cause? In fact, we'll learn in about nine lectures that it actually doesn't cause that much unemployment. It actually doesn't. So maybe the trade-off isn't that bad. But in principle, there's a trade-off.

Now, that comes to your point about shutting people's water off and things like that, and the government making sure that the suppliers make sure people's water doesn't get shut off. Once again, one way to do that is just say to the water company, you can't shut people's water off, even if they don't

pay their bills. Well, that's going to mean the water company's going to lose money on those people. That'll raise the cost of supplying water, and that will lead to the same kind of problems we've talked about.

AUDIENCE: But if a price cap and a--

PROFESSOR: But if the government then says, OK, a price cap, and then we're going to pay you for the people who don't pay, that's kind of like the idea before. You can have these countervailing interventions. But then it starts to get messy. You've got to raise the money to pay them, et cetera.

So that's why equity is so hard. If it's efficiency, it's easy. You just don't do anything. With equity, it gets a lot harder, because government has to intervene to address equity, and then that causes other problems. It causes these equity efficiency trade-offs. And that's a lot of the problems it raises.

So now let's talk about one last example to stop. I don't have a diagram for this one, but let's talk about the great example-- it's a real world example that happens a lot-- which is water shortages. How many people here from California? You guys know water shortages. You guys know about how this works. You guys know the drill. Which is that there'll be a drought, and the government will say, you can only use x gallons per day.

You can't water your lawn or-- actually, let me ask the Californians. So does the government monitor your meter or just tell you? Is it enforced?

AUDIENCE: Tells us.

PROFESSOR: Just tells you. So the government says, you can't do this, you can't do that. Maybe they enforce it. Maybe they don't. Whatever. But the government comes in and says, look, there's not enough water. So as a result, we are going to limit your use of water. Yeah.

AUDIENCE: They also have tiered pricing.

PROFESSOR: OK, hold on. Time out. That's because the government got smart. So let's go back 10 years ago. So what they'll do is they'll come in, and they'll say, you can't use as much water.

Now, this has two problems, just like we talked about. First of all, there are households which would happily pay more to make sure they got to use the same amount of water. And those trades are not being made. The first inefficiency. Moreover, it's got the problem that you're not allocating the water appropriately. Some guys are just dirty and don't like to shower. Some guys are clean and care a lot about showering. I want to allocate the water to the clean guys.

But the government typically doesn't do that. It just says, don't use more than x gallons. So there's an allocation inefficiency as well, where the people that value the water the most aren't getting it the most. Now, tell me about tiered pricing.

AUDIENCE: So it's like if you use 0 to 80 gallons per year or per month or whatever, you pay a certain price. And then if you use 81 to 120, you pay extra on those gallons. And then you pay even more down--

PROFESSOR: Exactly. So what the government can do-- the right answer is that the government can use the price mechanism to deal with the shortage. And the way it can do that is by saying, we're going to let the price increase. We're going to let the price increase, and we are going to allow the price to be a function. You see us pricing, but you make that a function of the underlying conditions and water supply.

So basically, you have a tiered pricing, and if there's a drought, the prices all go up. So the government sets the price for water, and it says, look, the price this year will be higher if there's a drought. And what that will do is that will make sure whoever wants the water gets the water and makes sure we allocate it to the people who need it the most.

Can anyone think of another way you can do this? Never really worked in reality, but it's kind of a fun way to think about it. Well, imagine that what I did is I said, every Californian gets a certain amount of water permits. Every Californian gets-- I don't know how many gallons of water people use. I don't know. You get 1,000 gallon a year water permit. How many gallons of water people use in a year? I've got no idea. 1,000? Let's say 1,000.

1,000 gallon a year water permit. We're going to give you 1,000 pieces of paper. Each one permits you to use a gallon of water. Now, what we're going to let you do is trade those pieces of paper with your neighbors. So what we're going to do is we're going to say, in normal times, basically, there's enough water, everyone gets 1,000.

Then we're going to say, when times are tight that basically, you can only use 900 gallons. So what that's going to mean is that you're going to have to have permits that allow you to use those gallons. And you're going to have to buy those permits off your neighbors. So basically, we can allow neighbors to trade.

And the neighbor that says, I don't care about water so much-- so what's going to happen now is the government's going to say, this year, we only issue 900 gallon permits to each of you, instead of 1,000. Now, you're a clean person. You say, wait a second, I wanted to use 1,000 gallons. So you go to your neighbor and say, look, you're dirty. You don't need more than 800 gallons. Sell me your extra hundred.

The government gave you 900. I want my 1,000. The government gave me 900. Sell me your extra 100. The neighbors says, sure. And they set a price, and they sell to you, and it works out to be exactly the same outcome as if the government had used the proper pricing, because that secondary market-- somebody asked about black markets-- this secondary market can evade the government regulation.

So once again, the market equilibrium is very robust. And if you can figure out a way to evade the government regulation, you will. If there's some way with permits, if there's some way to trade-- now, in reality, you can't really trade water. But if you could, then you could use a market mechanism to overcome this problem. Yeah.

AUDIENCE: Is that what-- one of the suggestions was for the global warming type thing, the carbon credits--

PROFESSOR: Exactly. So global warming-- actually, I flew with Al Gore over to Kyoto in 1997 and negotiated the global warming treaty. So something near and dear to my heart. And with global warming, that's exactly the solution that's part of the Kyoto protocol, the framework that was set up at

that meeting, which is that basically, there will be a certain limit on how much carbon dioxide can be emitted into the air. But there'll be permits, and countries can actually trade across each other.

And the idea is, look, in the US, it's incredibly expensive to reduce the emissions we have. Because what you have to do is you have to take a coal-fired plant and retrofit it to use natural gas instead. Well, in China, they haven't built the plant yet. They're building the plant. And it's not that much more expensive to build it to be natural gas instead of coal.

So in China, it's pretty cheap to reduce emissions. You just say, OK, I was going to build a coal. I'll build a natural gas instead. It's pretty much the same cost. I've just reduced emissions. So the idea is that we would trade with China, we would pollute more, China would pollute less, but the global total would be the same.

Now, as you hear that, you might think that's kind of controversial. But in fact, it makes total sense. Just like it might be controversial that dirty neighbors are selling water to clean neighbors. You can imagine the newspaper articles, the outrage. People forced to be dirty to make ends meet. But that's not right. What's right is you want to allocate to people for whom it's most efficient.

It is more efficient for China to reduce emissions because it's cheaper than for the US to reduce emissions. So the efficient system, we say, here's the total amount of emissions we're going to reduce, and we're going to let China do extra reduction, or pollute less, and the US gets to continue our slovenly ways, and that's the efficient outcome.

One last thing on this note. Many of you may know who Larry Summers is. Larry Summers was actually my thesis adviser who then went on to be Secretary of the Treasury, had a somewhat failed stint as president of Harvard and is now Obama's top economic advisor. Well, Larry Summers has gotten himself in trouble two times. You all know about the time he said women are stupid.

But the other time he got himself in trouble was in 1990, he actually signed his name to a memo. He didn't actually write it. Signed his name to a memo saying that the efficient thing to do is we should ship all our garbage to poor countries. And he said that's efficient because poor countries, what do they have? They have lots of space and not much money. What do we have? Lots of money and not much space. So the efficient thing to do is we should take our garbage and put on barges and send it to Africa.

He was right. That is the efficient thing to do. Africans would be better off, because they have lots of space they're not using, and they'd be richer. The US would be better off, because we would be able to get rid of our garbage, and we're happy to pay to do it. That's the trade to make it better off.

And yet, it got him fired, writing that memo. That's why economics is the dismal science, because we point out things like this. All right, let me stop there, and we'll come back on Wednesday and start talking in more detail about consumer demand.

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