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PROFESSOR: Hi, welcome back to the 14.01 problem solving videos. Today we're going to work on p-set 1 problem number 3 from Fall 2010. And we're going to work through all four parts of this problem. But to start off I'm just going to read through part A.

Consider the market for apple juice. In this market the supply curve is given by quantity supplied equals $10 p_j$ minus $5 p_a$, and the demand curve is given by quantity demanded equals 100 minus $15 p_j$ plus $10 p_t$, where j denotes apple juice, a denotes apples, and t denotes tea.

Part A asks us to assume that p_a is fixed at $\$1$ and p_t equals 5 . We need to calculate the equilibrium price and quantity in the apple juice market. So to start off this problem, I wrote down both the supply and the demand functions. But before we get started with the algebra, I wanted to come over to this graph and I wanted to think about conceptually what we're going to be doing.

When we solve for an equilibrium price and the equilibrium quantity, all we're doing is we're finding the point at which the quantity supplied and the quantity demanded is equal. Looking at the graph, that point is going to be right here where the two curves intersect. So this will be q^* , our equilibrium quantity, and this will be p^* , our equilibrium price.

So for part A we're just solving for the equilibrium price and quantity. And they try to trip you up on this problem by throwing in the price of apples and the price of tea. But since they tell us what these prices are initially, we're just going to plug these into our supply and our demand functions. And once we do that, we'll have isolated the p_j variable and the q variable so we'll be able to solve through for this problem.

So starting off with part A. We're going to go ahead and we're going to set the quantity supplied equal to the quantity demanded. And so for my supply function, I've already plugged in p_a . And after plugging in p_a I found that $10 p_j$ minus 5 is the supply curve. And the demand curve is equal to 150 minus $15 p_j$. Solving out for p_j I find that the equilibrium price is equal to

6.2. And since I know this is an equilibrium price I'm going to go ahead and I'm going to label this with a star.

Solving through for the equilibrium quantity all we have to do is we have to take this equilibrium price we found and plug it back into either the supply curve or the demand curve. I'm going to go ahead and I'm going to plug it into the supply function. And that lets us solve for the equilibrium quantity denoted with the star. And that in this case is 57.

So looking at our graph, the equilibrium price and the equilibrium quantity, we can now label them. We can label the price, 6.2, and the equilibrium quantity 57.

Let's go ahead and move on to part B. Part B is going to be the exact same scenario as we started off with in part A, only what we're going to do now is we're going to shift the supply curve by changing the price of apples. Part B states, suppose that a poor harvest season raises the price of apples to p_a equals 2. Find the new equilibrium price and quantity of apple juice and draw a graph to illustrate the answer.

Now what's happening in this scenario is that the demand curve is completely unaffected. The only thing that's changing is our supply curve is shifting. So when we look at our supply curve we have to think about conceptually what do apples represent. Well they're an input for the suppliers. It's something they have to use to make the apple juice. And if the price of apples is increasing then we intuitively know that this quantity, or this q star that they produce before, it's going to be more expensive for them to produce it. And, in fact, it's going to be more expensive for the suppliers to produce any given quantity. So this means that the supply curve for part B is shifting up and to the left. I'm going to denote this by labeling our new supply curve s_b for Part B.

So for Part B all we're going to do is we're going to plug in this new p_a price. And then we're going to do the same thing. We're going to set the quantity supplied and the quantity demanded equal. When we solve through for a new supply curve we find that $10p_j$ minus 10 is our new supply curve.

And we know that our demand curve is going to be exactly the same as the scenario that we started off with in Part A. Solving through for the new equilibrium price we find that p_j is going to be equal to 6.4. I'm going to label this new equilibrium price with a B. And then we can take this equilibrium price, we can plug it back into either our new supply curve or our demand curve. And we can find that the equilibrium quantity is going to equal 54.

And when we look at our graph we can think about what these quantities and these new prices looks like. We can see that the quantity for part B clearly should have shifted down, and it did drop from 57 to 54. And we can see that the price is higher than what we started off with. It rose from 6.2 now up to 6.4. So we can see that our intuition that the supply curve would shift up because it's more expensive for suppliers makes sense according to both our algebra and to our graph.

Let's go ahead and try part C. Part C is going to be another shift, but what's happening now is this new shift is going to affect the demand curve not the supply curve. Part C states, suppose that p_a equals 1, but the price of tea drops to p_t equals 3. Find the new equilibrium price and quantity of apple juice.

So for this scenario now, our p_a is back to 1, like it started off with in part one. But now t is dropped from five to three. Now before we start, let's think about what t actually represents to the consumers in this market. If I'm a consumer and I'm debating what I want to drink in the morning, one of my other choices might be tea. Now the price of tea drops, then maybe I'll be less willing to pay as much for the apple juice because they can just go out and get the cheap tea now.

Looking at our graph, if the consumer is less willing to pay as much for each quantity of apple juice as they were before, this scenario means that the demand curve has shifted down. So, for example, the equilibrium quantity that we started off with an point A, they used to be willing to pay this much, now they would only be willing to pay this much for the same quantity because tea is cheaper.

Now we're going to be using the same supply curve that we started off with before. So in this scenario we're looking to set supply and demand equal and find this new equilibrium point. When we go through and we actually plug in the new p_a and the new p_t , we're going to find that the supply and the demand functions. When we set them equal we're going to set $10 p_j$ minus 5 equal to 130 minus $15 p_j$.

Again we're going to solve through for p_j . And we're going to find that our p_j for part C is going to be equal to 5.4. And we're going to find that the new equilibrium quantity, again either plugging back into our supply curve or demand curve, is going to be equal to 49.

And when we think back to our original part A, we found that the price was 6.2. Now the price

dropped down to 54 or 5.4. And what we see here, is that we did see a price decrease, or we could have predicted a price decrease according to our graph. And we also find out the quantity dropped from part A in 57 now the 49. And according to our graph, we would have predicted that quantity would have decreased as well. So the algebra and our graph both match up.

Let's go ahead and move on to part D. Now we're going to look at the effect of a government intervention on the market for apple juice. Part D says, suppose that p_a equals 1 and p_t equals 5 and there's a price ceiling on apple juice of p_j star equals 5. What is the excess demand for apple juice as a result? Draw a graph to illustrate your answer.

So now we're back to the original scenario we started with in part A. We have the price of apples is equal to 1. And we're back to the price of tea equal to five. And now the only thing that's different in this scenario for part D is that the government said that these suppliers can't charge any price higher than 5.

So let's go ahead and let's think about what this looks like conceptually on a graph. In this scenario we started off with an equilibrium price of 6.2. If we were to have a case where the government was saying you could charge only as much as 7 in the market for apple juice, the suppliers wouldn't even be affected. Because they would say, that doesn't affect us, we're charging 6.2. That's too high. We're not going to have to change anything we're doing.

But in this scenario the government is saying the most you can charge is 5. Now at the price of 5, the quantity supplied, or the intersection of the price of 5 with the supply curve, is going to lead to a q_s that's different than the quantity that's demanded. And more specifically we're going to find that too many people are demanding the product and there's not enough being supplied in the market.

This is what we're referring to when we talk about excess demand. We're talking about the space between the quantity that's supplied and the quantity that's demanded. And that's what we're going to be solving for. So by plugging in the price cap of 5 into both our supply curve and our demand curve, we'll be able to find the difference between the amount that's supplied and the amount that's demanded.

So plugging into our supply curve we can find that the quantity supplied is going to be equal to 45. And plugging into our demand curve we can find that the quantity demanded is going to be equal to 75.

Now one of the biggest problems that students run into on this problem is they think they're done when they reach this point. All right, I found the quantity supplied, I found the quantity demanded, I know they're different. I'm done.

But really what you need to find is exactly how different the quantity supplied and the quantity demanded is. You need to find out how many consumers are left out of the market. So our excess demand is the difference between the quantity supplied and the quantity demanded. And that's going to be 30 in this case.

So just to review what we did in this problem, we started off by setting a quantity supplied and a quantity demanded equal to solve for a basic equilibrium price and quantity. We then looked at shifts in supply and demand and looked at how that affected the price and quantity in a market. And finally, we ended with part D with looking at the effect of a government intervention. How does a price cap affect how many people can get a product compared to how many people want a product.