**W12 V2 Pigouvian Taxes and Subsidies**

0:09  
In this video, we're gonna talk about how to use government interventions, specifically taxes and subsidies, to implement the efficient outcome as the market outcome.

0:19  
And then we're going to try and convince you by calculating surpluses and checking whether there's a deadweight loss with the appropriately chosen tax or subsidies.

0:28  
Not any tax or subsidies.

0:29  
It's the appropriate tax as a subsidy, Which is why we give this a fancy name called a Pigouvian tax or subsidy.

0:36  
OK, so now here's the problem with externalities.

0:38  
We have this gap, this wedge.

0:40  
Again, This is why we made you suffer through taxes as wedges, because this is where it pays off.

0:44  
There's a wedge between private costs and private social costs or benefits, and a tax is a way to correct for this wedge.

0:55  
And I really want you to bring all of that effective price thinking, the wedge method in here because it's going to pay off really well here if you've done that hard work there.

1:05  
OK.

1:06  
What your goal is, is to change the effective prices for the consumer and producer so that when they face those effective prices, they choose the efficient quantities as the market quantity.

1:20  
OK.

1:20  
So let's think about this way.

1:22  
So we're going to work backwards from what we've done before.

1:25  
Before we were saying given a tax, here's the market outcome that will result here.

1:31  
We're like, I want to target this market outcome.

1:34  
How can I back out what the tax is?

1:36  
So you're just using the same concepts from an earlier module but flexibly so that we can work backwards.

1:42  
And we're going to use a tax as wedge method because it's the fastest, best way to do it and requires you to go back and make sure you understand effective prices.

1:51  
OK.

1:52  
Now, the two ways that I'm going to show you how this works, and they're both going to lead to the same thing, same concepts really.

1:59  
One is to use the taxes as a wedge method.

2:02  
It's really fast, really simple, because it's effectively taking all of the hard work we've done in Module 6 and just reversing that in here.

2:10  
OK, backing out effective prices that implement the effective quantity.

2:15  
You could also do a shortcut in here and you should do both of them because it helps you check whether your answers are correct or not.

2:23  
Is to say that I'm going to use this to understand or to figure out that actually that tax is related to the external cost and benefit.

2:32  
In fact that wedge that we need to implement is going to be the marginal external cost and or benefit at the efficient quantity.

2:41  
There's something specific about the tax that we'll find, and we can use that insight as a shortcut.

2:46  
But I would only recommend this method once you've understood method one correctly, because you want to understand the economics in here.

2:53  
The second method is just a shortcut method, but it is useful on an exam to check your calculations and check your intuition as well.

3:00  
OK, so let's start off with the first method, which is using effective prices.

3:04  
So here we're working backwards.

3:06  
We're going to say I'm going to look at social costs and benefits.

3:08  
I'm going to find the efficient quantity.

3:11  
OK, then I'm going to say I know how people make quantity choices.

3:16  
I know that consumers react to their effective price.

3:21  
I know that producers react to their effective price when they make their choices.

3:26  
I know that in a tax equilibrium, when we have those two effective prices, prices adjust so that quantity demanded is equal to quantity supplied and tax is a wedge between those two prices.

3:43  
So before I was given the tax and then from the tax, I use this equation and that equation to figure out what the quantity is.

3:50  
Here you're working backwards.

3:52  
You're saying I know what the efficient quantity is.

3:55  
That's my starting point.

3:56  
What do the prices have to be for demand and supply to get them to choose those quantities?

4:03  
And then from that I can back out what the tax has to be to implement that outcome as the wedge between those two effective prices and show you how that works on a diagram.

4:14  
So here's a diagram where we have a negative production, accidentally production because in the supply curve, negative because the cost of society is higher than the private cost of production.

4:25  
In this case, if I don't intervene, this is what the market quantity is going to be.

4:30  
But now I do not want that quantity to result.

4:33  
I want this quantity to result.

4:35  
I want that to be the efficient quantity.

4:37  
So step one is figuring out what this quantity is.

4:39  
Step 2 is to say what does PD have to be so that when consumers face this quantity, face this effective price, the quantity that they choose is exactly the efficient quantity.

4:54  
So I'm going to take this quantity.

4:57  
I'm going to look at consumers willingness to pay because I know that that's how they make decisions.

5:03  
Willingness to pay price, willingness to pay price.

5:06  
They will stop at this quantity only if this is their effective price, right?

5:12  
So I'm going to take the quantity, I'm going to project it on to the willingness to pay.

5:15  
And I'm going to say if they face this magic price PD, then they are going to choose this efficient quantity because only those quantities pass.

5:24  
The marginal willingness to pay versus marginal cost or the price barrier.

5:28  
Same thing for producers.

5:30  
I'm going to say I want to find a price so that when I look for this price along the supply curve, along the marginal cost curve, producers choose the efficient quantity.

5:43  
So I'm going to take this quantity, I'm going to project it onto the marginal cost curve, and I'm going to say that is what the price effective price to producers has to be in order to get them to choose this quantity.

5:57  
So I'm going to use Q efficient in order to identify PD and PS, OK.

6:08  
And then I'm going to say, look, if I didn't have the PD and PSI would be at this P star.

6:13  
But now I want PD and PS.

6:15  
So I need to throw away the red curve, right?

6:18  
Throw away the red curve and have just private costs and benefits.

6:22  
This is my demand, which is my Marshall willingness to pay.

6:25  
This is my supply, which is my marginal cost price quantity.

6:30  
If I don't do anything, they're going to be here.

6:32  
But if I choose the right wedge, if I choose this wedge, that exact amount, this is what PD is going to be.

6:40  
This is what PS is going to be.

6:41  
That's my tax module.

6:42  
I know exactly how to work with that.

6:44  
But now I know that if I choose that wedge, it's going to implement the PD and PS, that magically also turns out to be the efficient outcome.

6:55  
This is what's going to be the Pigouvian tax in our words.

7:02  
So tax here, we will just be backing out with the gap between PD and PS has to be then with this tax, we'll get the PD and PS that when people react to that PD and PS, they choose the efficient quantity.

7:16  
Now let me clean this up and we can talk surpluses, OK.

7:19  
We've identified everything in here.

7:21  
We can talk about surpluses.

7:23  
OK, Now I don't care about the old market equilibrium because it turns out that when you impose this wedge, that's the tax, this gap, this efficient quantity is actually going to be my market quantity with the tax.

7:46  
So what is my market surplus with a tax?

7:56  
What do I need?

7:56  
I need consumer surplus.

7:58  
This is 1.

7:58  
Again.

7:59  
Shifting curves hurts you if that's all you've done in module 6.

8:03  
Thinking about effective prices, you know, consumer surplus, the difference between willingness to pay and the effective price paid.

8:12  
Consumer surplus.

8:13  
Producer surplus.

8:16  
Difference between effective price, marginal cost, producer surplus, government surplus, government revenue.

8:28  
They get the tax for every unit being traded in the market.

8:35  
This is my government surplus.

8:38  
This point you're going to be like this is not different from anything we've done so far.

8:43  
Why?

8:44  
Why do we have this tax revenue?

8:46  
The answer is it is different because guess what, we have the external cost and benefit in here.

8:52  
Now here this is the total external cost because it's a negative externality.

8:56  
How much is the negative externality and marginal externality is this gap between private and social costs, right?

9:04  
So if I'm looking at that for every unit that is actually being produced in the market, that is my external cost, OK.

9:16  
And it's a negative cost.

9:18  
So society wide total surplus will be consumer surplus plus producer surplus plus government surplus minus the external cost.

9:30  
And graphically when you look at all of that, this is what you're left with net great, fantastic.

9:40  
So that's my market surplus with the tax.

9:43  
What is the deadweight loss?

9:44  
Well, the deadweight loss, I need the efficient surplus, efficient surplus.

9:48  
I don't need prices because I need the efficient quantity.

9:50  
It's the difference between social benefits, social cost of the efficient quantity.

9:54  
Guess what it's exactly market surplus with the right chosen tax.

9:59  
So you can kind of see that the right tax, the Pigouvian tax that implements the right prices that get people to choose the efficient quantity results in the efficient market outcome.

10:11  
It is not that we have 0 externality imposed.

10:14  
We do have an external cost in there.

10:16  
It is not that we're going to zero production.

10:18  
We do have a positive production in here.

10:21  
But what is true is we've chosen the right quantity so that for that quantity, that's a result of people's choices.

10:28  
It is a market quantity with the tax that's going to result in the efficient total surplus.

10:33  
After I add and subtract everything else in here, I'm going to end up with the efficient surplus implemented in here.

10:40  
Please remember again, this is the right chosen tax.

10:43  
It's not for any tax in here.

10:45  
It's if you choose the right tax.

10:47  
Now, I can go through this long process and figure out what the right taxes to this process or I can take a shortcut.

10:55  
What's the shortcut in here?

10:56  
It's saying, well, this cab, this gap is between this with this wedge between PDPS, that kind of stuff.

11:04  
What exactly is that wedge?

11:05  
Well, the wedge that we're looking at, the tax that we're looking at is this gap between social costs and private costs.

11:12  
So I know that gap is the externality, but this externality varies in the way that I've drawn it, right.

11:17  
So what exactly is it?

11:19  
It's the externality at the efficient outcome, right?

11:22  
It's that gap.

11:23  
The Pigouvian tax is the marginal external cost at the efficient quantity.

11:37  
OK, varies all along.

11:39  
But if you pick the right one, which is the external cost at that quantity, you implement the efficient outcome.

11:47  
OK, here's what we're going to do and convince you with the same thing.

11:52  
So I'm going to use the second method with a different example to show you that they're both equivalent.

11:56  
OK, we're going to start off in the same place.

11:59  
What's the efficient one?

11:59  
Because if I want to implement the efficient, I need to know what the efficient is.

12:02  
Start off with the same thing, but you're going to take a shortcut.

12:04  
What you're going to say is what is the marginal external cost of benefit at this quantity?

12:10  
And then the shortcut you're going to say is, well, that should be the Piguvian tax or subsidy.

12:15  
I'm not going to worry about PD or PS.

12:17  
I'm just going to take a shortcut, Find that, and then I'm going to impose that and that magically is going to result in the right ones.

12:24  
Why?

12:25  
Let's show you.

12:26  
But Please remember, this is a shortcut.

12:28  
I only want you to use the shortcut once you've understood the effective prices, the taxes, as a wedging backing out method one.

12:36  
This is a shortcut that you really should use only to check your work at this stage.

12:42  
OK, let's.

12:43  
But let's do it in here.

12:44  
What's the efficient quantity?

12:46  
Efficient quantity right there.

12:48  
Step one.

12:49  
Now in the previous one, we want to go on what's PD, what's PS?

12:53  
And back out from here.

12:54  
Now we're going to take a shortcut.

12:56  
We're going to say this is a externality that's coming from consumption.

13:02  
And this is an externality where the cost to society, the benefit to society, is actually higher than the private benefits.

13:10  
So it's a positive consumption externality.

13:13  
OK, what is the external cost of benefit?

13:15  
The marginal external cost of benefit is this gap, right?

13:18  
So this is the marginal external benefit at any quantity.

13:21  
OK, now I don't want any marginal external cost and benefit.

13:24  
I want the marginal external benefit cost and benefit at the efficient quantity.

13:29  
This is the one that I'm interested in.

13:32  
OK.

13:32  
This is the marginal external cost of benefit in this case is the benefit at the efficient quantity.

13:40  
So don't worry about any of these, I don't care about any of those.

13:42  
That's what I want.

13:44  
If I just choose that as a tax, then what is the market outcome going to be?

13:49  
Well, we know taxes is a wedge, taxes is a wedge between demand and supply.

13:55  
Then if I project this wedge from the demand side on to the price, I'm going to get this to be PD.

14:04  
What about for producers?

14:06  
Then I take that wedge, I look at the supply curve, which is the marginal cost curve.

14:11  
Project that onto this axis and I'm going to get PS.

14:15  
OK, so here's what I've done.

14:16  
I've used the marginal external benefit.

14:18  
In this case, it's a consumption benefit and I've used that to find PD and PS.

14:26  
That will result if that's the wedge, if that's the wedge with this PD and PS, when consumers choose this PD and PS, I'm gonna get the same quantity, which is the efficient quantity in here, right?

14:44  
So use the shortcut rather than find what PD and PS has to be and then back out what the A wedge has to be.

14:51  
I'm kind of saying I know what the wedge is.

14:52  
I'm gonna impose that wedge and then the PD and PS that will result will automatically be the efficient quantity in here.

15:01  
OK, so that's kind of the shortcut method.

15:02  
Notice it feels very unsatisfying, right?

15:05  
Because how do we just pick this?

15:08  
Does I pick anything in here?

15:09  
Does it automatically mean?

15:11  
That's why it's going to be a lot more unsatisfactory, especially when you're learning this to take the shortcut method.

15:16  
But if you have done this here with this method and you understand that this is what PD has to be, this is what PS has to be, and we can back up, then go ahead and use the shortcut method to say, I know already what the wedge is going to be, just impose the wedge.

15:30  
I know that that wedge will give me this PD and PS and then I can proceed from here.

15:36  
OK.

15:36  
So let's think about the market surplus.

15:38  
Oh, wait.

15:39  
But is this a subsidy or a tax at this point?

15:41  
You want to ask yourself that question, you know from the tax module how to do that in here?

15:47  
You're looking at PD, you're looking at PS and you're saying in this case PS is going to be higher than PD.

15:55  
What does that mean?

15:55  
That means that money is flowing from the consumers pocket and before it gets to the producers pocket, that money increases.

16:03  
Why is that money increasing?

16:05  
Because the government here is pumping in a subsidy, right?

16:08  
It's not a tax.

16:09  
It's a negative tax.

16:10  
It's a subsidy.

16:12  
And that subsidy is exactly the amount of the marginal external benefit at the efficient quantity.

16:21  
OK.

16:21  
So when PS is higher than PD, you know, it has to be a subsidy.

16:24  
PD is higher, You know, the government is pulling money out of the transaction and it's going to be a tax.

16:30  
OK, good.

16:30  
Now that I have this, I can throw away the red curve for now to figure out producer surplus, consumer surplus, market surplus at the quantity with the subsidy in this case will depend on consumer surplus.

16:49  
Consumers are have this willingness to pay, they are going to pay this effective price.

16:55  
They're going to be really happy.

16:57  
That's their consumer surplus producers.

17:00  
On the other hand, they are also happy they're getting a nice high price.

17:05  
Their costs are the same, but they're also producing more, right?

17:10  
The producer surpluses are also going to be happy.

17:14  
Somebody who's unhappy in here, and that person who's unhappy in here is the government, because the government has to pay this amount of money.

17:34  
OK, At this point, without externalities, you stop here and you'll be like, oh, that's the dead.

17:38  
We lost that triangle in that.

17:40  
All right.

17:40  
Because they're not producing the efficient quantity.

17:42  
This point that should give you pause, That thinking in your head should give you pause because guess what?

17:46  
We are producing the efficient quantity.

17:47  
So let's take a pause and see if we're missing anything.

17:50  
You are missing something.

17:51  
What are you missing?

17:52  
You're missing the external part.

17:55  
And what are you missing?

17:55  
The external benefit.

17:58  
OK.

17:58  
So here there are people who are benefiting from this transaction and they're benefiting by this much.

18:05  
This is surplus that's been added to the economy through the externalities, right.

18:14  
So the market surplus will be the sum of total surplus here, consumer surplus, producer surplus, government surplus.

18:27  
OK, government surplus here is negative because they're paying money.

18:30  
So got to subtract off the government surplus, what I'm adding in the external benefit.

18:35  
Once you do that and you look visually, I'm going to add the 2 blue areas together with some of those blue areas is taken away by government surplus because they're got to pay for all of that.

18:46  
But then government surplus is going too far.

18:48  
But don't worry because you're adding in all of the benefits in there.

18:51  
When you look at the net visually, what you're going to get is that is total surplus.

18:58  
So before we had a deadly loss because you're like oh, because of the subsidy, People are over buying.

19:03  
But here it's fine, they're buying.

19:04  
Governments are paying for it.

19:06  
But guess what?

19:06  
There's a benefit accruing to somebody in the economy through that externality and that extra paid by the government is cancelled out by that externality cost.

19:13  
So that part disappears.

19:15  
The green area and the black area overlap.

19:17  
One is +1 is negative.

19:18  
That disappears, leaving us with just the yellow area.

19:22  
What is that yellow area?

19:23  
That yellow areas also the efficient surplus, right.

19:27  
So with the right chosen Pigouvian subsidy in this case, because we have a benefit, we want people to produce more because they're under producing in the market without the subsidy.

19:37  
The right chosen one, which happens to be the marginal external benefit at the efficient quantity, implements the efficient surplus in here, implements the efficient quantity in here.

19:50  
And it's a way you can finally start to see where government interventions are good, right?

19:56  
Externalities.

19:57  
Which is not a crazy thing to happen.

19:59  
I mean, the simplest example you can think of is pollution, right?

20:03  
This now gives us a role for the government, a role for why we would want to have taxes and no subsidies, A reason for why imposing taxes or subsidies actually improves efficiency and doesn't cause a deadweight loss that we saw without externalities in module 6.

20:19  
If you just stopped equal 1 on one and module 6, you think taxes are always bad, subsidies are always bad.

20:24  
But the reason why we see them, and especially the reason why we see them in externality producing contacts, is because it could play a role to increase efficiency.

20:34  
However, notice this requires a lot of information, right?

20:37  
It requires governments to know what the marginal external benefit is at the efficient quantity.

20:43  
That's a huge information.

20:44  
I'll ask what is the impact of pollution for every quantity?

20:48  
In fact, what's the efficient quantity And what's the extra impact of pollution at that efficient quantity?

20:54  
It's a huge informational requirement and we may not have data on that, right?

20:59  
So while taxes and subsidies can be efficiency improving and the right chosen 1 implements the efficient outcome, remember there's a huge information burden in here that has to be met because without the right tax, we could have additional inefficiencies being introduced.

21:16  
OK, now the question is, suppose we've solved that information thing and was like, who pays the tax?

21:21  
Who should?

21:22  
When I'm writing the bill in Parliament, who should pay the tax?

21:26  
They come and ask the economist.

21:28  
And when we see the word who should pay the tax, we interpret that as statutory incidents.

21:34  
And for us we're like, it doesn't matter.

21:36  
Statutory incidents only determines market price.

21:39  
That was the big insight from Module 6.

21:41  
OK, so I don't care who pays the tax on paper.

21:44  
I don't care which price you posted, the market price, PD or PS, because the outcome in terms of effective prices, in terms of the quantity, doesn't change.

21:55  
So you pick whoever you want to pay the tax.

21:57  
On paper, economists will say it doesn't matter.

22:01  
For us, what we do care about is economic incidents.

22:05  
Who effectively pays the burden of this tax in terms of effective higher or lower prices and that depends on relative elasticity.

22:13  
That's the insight coming in from all your modules, right.

22:17  
So it's not something that depends on the externality or because we are making consumers pay for the tax on paper.

22:24  
That's what's going to make consumers worse off.

22:26  
No, what makes consumers better off or worse off is a change in effective prices that depends on relative elasticity's.

22:32  
Keep that insight.

22:33  
That's an important insight that we're going to bring back in from Module 6.

22:37  
OK, here's another thing that comes up.

22:39  
What if there's two externalities, right?

22:41  
Well, gas being a primary thing.

22:43  
The act of producing gas is pollution.

22:46  
Causing that imposes a negative production externality.

22:49  
The act of driving a car with gas is a consumption externality, right?

22:54  
Because my act of consuming releases pollution LED into the air.

22:59  
What happens when there's two of them?

23:02  
Do it the same way that we've just done.

23:05  
Just remember that there's two things happening at the same time.

23:08  
OK.

23:08  
So one is you're saying, oh, you know what?

23:10  
Here's a problem.

23:11  
There's a cost to society.

23:12  
Fantastic.

23:13  
This is my cost to society.

23:16  
Then you're saying, oh, you know what?

23:18  
There's a willingness to pay.

23:19  
And then there's this negative externality that's coming in here.

23:23  
This is my marginal social benefit.

23:26  
Fantastic.

23:27  
OK, good.

23:28  
Follow the same procedure.

23:29  
Put all of that information in.

23:30  
Figure out what the efficient quantity is and then say what do I need PD and PS to be to get this efficient quantity implemented?

23:41  
That's all right.

23:42  
It doesn't matter how complicated you done if you're understanding the mechanisms.

23:45  
If you're understanding what happens where, figure out the efficient quantity, then oh, you know what to implement this, This is what PS has to be to implement this.

23:53  
This is what PD has to be.

23:55  
And guess what?

23:56  
It's the net effect of the external costs or benefits at the efficient quantity.

24:04  
So the add efficient quantity stays the same that Insight stays the same.

24:08  
It's just that here there's two costs.

24:10  
Fine.

24:10  
Add them both up, or one cost and one benefit?

24:12  
Fine.

24:13  
Figure out the net after canceling each other out.

24:15  
If you're sticking with the intuition, it doesn't matter how we change this, you'll be able to handle it.

24:20  
OK, so Pigouvian tax and subsidy.

24:23  
I want you to start by saying how do we figure that out?

24:27  
By trying to start with implementing the efficient outcome using tax module.

24:32  
Once you have that, you will notice it is equivalent to the marginal external cost and benefit at the efficient quantity.

24:38  
And then you can feel comfortable enough to start taking shortcuts by directly starting with that.

24:44  
But please do not get there until you're comfortable with the taxes as a wages intuition and then notice that because if we choose the correct tax or subsidy, we're going to implement the effective prices that reach the efficient outcome.

25:00  
So the actual market outcome with the correct tax or subsidy will end up being the efficient outcome because of your correctly chosen prices.

25:09  
You're changing incentives through changing effective prices, and that is what's going to lead to a role for the government in improving efficiency and reducing deadweight loss.