**W7 V3 Cost Curves**

0:09  
In this video we're gonna introduce you to the concept of a cost curve.

0:14  
And the reason we do that is cuz it's really easy to work through what happens when stuff in the environment changes.

0:21  
OK, so for each one, I'm gonna walk you through the intuition so you hopefully don't need to memorize and you can understand what we're doing and why we do it in this particular way.

0:32  
OK, now why do we use graphs at all if we're just thinking about cost?

0:36  
Why can't I just have an Excel spreadsheet and do that?

0:39  
And the answer to that is, well, if you can visually work through, if you remember demand and supply, if I had a bunch of Excel spreadsheets to work with to figure out what would happen, it would make my life really complicated.

0:52  
I could do it, but a graph has a quick way for me to capture the intuition.

0:55  
What's happening?

0:56  
Oh, this is changing.

0:57  
That's changing.

0:57  
Great, I can work through it.

0:59  
That's the main reason why we use these cost curve graphs.

1:02  
OK, it's a really quick way to work with changes in the environment and make predictions.

1:07  
So you really need to know how to work it.

1:10  
Now there's a bunch of costs.

1:12  
You've seen all the definitions and there's average and marginal and all.

1:16  
What curves are the most essential curves and why do we include those curves?

1:20  
Let's go back.

1:22  
Module one, What do we need to solve the first firm's problem?

1:26  
First principle, all costs are opportunity costs.

1:29  
OK, good, we're keeping track of that.

1:31  
Second one, I need to know principle two.

1:38  
I need to solve for the quantity choice.

1:41  
What quantity will they pick?

1:43  
Well, for that I need price VS marginal cost.

1:47  
So one curve I need, and that's an important curve, is the marginal cost curve.

1:52  
OK, So I need to figure out what the marginal cost is for every quantity.

1:55  
Second thing, I need principle three produce or not.

2:03  
For that, what do I need?

2:04  
I need total cost, right?

2:06  
And I'm going to need total cost.

2:09  
And just kind of a heads up sometimes I'm going to need variable costs in here and we'll talk about why we need this difference.

2:14  
OK, But that's what I need.

2:17  
Now here's a problem.

2:18  
If I've got quantity and I'm plotting marginal cost, that's OK, right?

2:22  
Cost of the extra extra unit.

2:24  
But once you start summing up extra cost, extra cost, your averages can, your total cost can balloon to insane numbers.

2:31  
OK, So what we want to do is to find a way to be concise on the diagram, but also to compare visually.

2:39  
So here's the trick we use.

2:41  
We say profits.

2:44  
This is what I mean by profits.

2:46  
You know what?

2:46  
Let me just write the word profits.

2:48  
Profits is revenue.

2:52  
Total cost.

2:55  
What is revenue?

2:55  
Revenue is price times quantity and this is the total cost for this quantity.

3:02  
Price taking forms.

3:03  
Quantity.

3:04  
Prices given to us.

3:05  
We react to prices, sure, but price is used in two ways.

3:10  
Price is used in revenue.

3:12  
Price is also used to compare to marginal cost.

3:14  
So I really want to have price on one axis.

3:17  
OK, now totals is going to balloon all of this.

3:21  
What do I do?

3:21  
I use a trick of averages.

3:24  
OK, so I'm going to say here's my profit and I'm going to divide it by the quantity.

3:30  
Here's my revenue divided by the quantity divided by the quantity.

3:33  
Just looking at averages.

3:35  
What this does is gives me a really neat way of comparing whether this firm should produce or not.

3:42  
Because I'm comparing price to average total cost to say price is higher than average total cost.

3:49  
Please go ahead.

3:49  
Produce price is lower than average total cost.

3:51  
Don't produce price versus marginal cost.

3:54  
Again produces quantity or not.

3:56  
How much do I produce?

3:57  
OK, so the other curves that we will use are the average curves, average total curves, total cost curves or average variable cost curves because sometimes we'll use that.

4:07  
Those are the three important curves we need.

4:09  
We're going to always compare that visually to price, and that is why we use those curves.

4:13  
OK, how do we put them?

4:16  
Fixed cost, by definition, 123 doesn't matter how much I produce.

4:22  
That's my fixed cost, which means that the more I produce, I can spread that average that cost over a larger number of units average fixed cost goes down fantastic marginal cost.

4:36  
Oh, now it's complicated, right?

4:38  
Because I got to go to see the inputs, I got to see how those inputs productivity changing and this can look like anything.

4:44  
OK.

4:45  
In Eco One O 1 where we typically assume costs like this, this is not always what your marginal cost will look like.

4:52  
When you get to the second year, you will use the math to derive this.

4:57  
In Eco One O 1, we draw this as a typical curve.

5:00  
Why do we do this?

5:01  
Because we are thinking of production in the following sense.

5:05  
Marginal cost eventually increases.

5:08  
Eventually as I produce more, the cost of the extra input goes up.

5:13  
Why?

5:13  
Because, you know, at some point I'm going to run out of space and I'm going to add those extra things and it's going to be hard.

5:18  
The bigger more I produce or as I input more resources into production, the opportunity cost gets higher and higher.

5:26  
It's pretty reasonable to assume that eventually marginal cost is increasing.

5:30  
But what about this section?

5:31  
What about marginal cost kind of decreasing?

5:33  
Well, if you think about it, you know you're working in your Taco truck, it's just you.

5:39  
It's one person.

5:40  
With this big truck, you add on an extra worker.

5:43  
That extra worker is going to be really productive, right?

5:46  
Two people.

5:46  
You can have some economies of scale and your cost will go down initially, but eventually you're going to have too many people in that truck and it's going to be a problem.

5:55  
OK, so don't get too caught up in why it must look like this.

5:59  
It doesn't have to look like this.

6:00  
It depends on the story you're telling.

6:02  
But typically we Draw Something like this to capture the idea that initially you have some economies of scale, but eventually costs will start rising.

6:11  
OK, now here's the tricky part, and here's where the memorizing comes in.

6:15  
If you don't understand what's happening, it's the relationship between marginal and average.

6:20  
GPA again is your touch point.

6:23  
If I tell you your GPA is here and you're adding a grade that's lower than that, it means that next semester your GPA is going to fall right when your grade that you're adding is lower than your GPA.

6:37  
GPA is coming down.

6:38  
If I'm adding, here's your GPA, and I'm adding a grade that's higher than your GPA, it's gonna pull it up, right?

6:47  
And if I add a grade that's exactly the same as your GPA, it is going to be the same.

6:54  
So let's put that in a graph and get that intuition.

6:57  
OK, this is my GPA in my extra course marginal cost.

7:06  
OK, here's my average.

7:09  
When my GPA is higher than the course that I'm adding, it's going to pull that extra course is going to pull my average down.

7:19  
When my GPA is average GPA is lower than the course that I'm adding, it's going to pull it up.

7:27  
All I'm looking for is whether it's higher or lower than the average when I'm deciding whether the average is going to increase or decrease the extra class.

7:36  
OK, now whether this extra class or you know what, actually, I started off good, but then I got bad in the second year, I don't care.

7:43  
Is that extra, great?

7:44  
Higher or lower than your average?

7:46  
That's the only thing that matters.

7:48  
Higher than lower than your average, all right?

7:50  
Tell you which direction it's going.

7:51  
If it's exactly the same, it gonna be exactly the same.

7:55  
So if I'm looking for the minimum average, the minimum average GPA, I'm really looking for that point where your marginal kind of cost is equal to your average cost, OK.

8:09  
That's when they I hit the, that's when they are the same and then below that it's going to decrease and above that it's going to increase.

8:17  
That's it, right.

8:19  
The average total cost look like this average variable cost will be slightly less than your average total cost if you have a fixed cost component, right?

8:28  
Because average variable cost will be added on to your average fixed cost to get your average total cost.

8:35  
But the intuition the relationship between marginals and averages is still the same.

8:40  
So you don't need to memorize that ATC is equal to MC at the minimum.

8:45  
There's a lot of memorization in there.

8:46  
If you remember your GPA calculations, which you guys are doing all the time, you understand why this is important.

8:52  
We're going to use this a lot in the next module, so please understand why this is the case instead of memorizing it.

8:58  
Now, this equality only holds true if we have nice continuous cost functions.

9:03  
If we don't have continuous cost functions, then we're going to have approximately where we are.

9:08  
Look at the problem set.

9:08  
It gives you some examples of that to show you how we approximate it when we have discrete data.

9:15  
Once you have that intuition, then you can handle anything we throw at you.

9:18  
What happens when input prices change?

9:19  
Technology, right?

9:21  
Short run, long run, if you understand the basic costs and what they depend on, you're good.

9:27  
Let's do a simple example to help you see that you're good.

9:30  
OK You're thinking about agricultural costs.

9:33  
You're thinking about producing, I don't know, whatever plant you want, wheat, corn, whatever it is, right?

9:38  
And the seeds you're using, that's the input that you're using to get more output.

9:43  
First question, is this a variable input or a fixed input?

9:46  
Because that's going to depend on which costs I'm going to think of.

9:51  
It's reasonable to think about a seed being a variable input, right?

9:53  
More wheat means you've got to plant more seeds.

9:56  
OK, good.

9:57  
So I'm looking at that cost being affected.

10:01  
Once I have that fundamental cost, I can back out all of the cost that I need.

10:06  
Variable cost, average variable cost, average fixed cost, and average total cost.

10:17  
OK.

10:18  
So you start off by drawing the curve that's being affected.

10:22  
I'm going to use blue for the initial and then red for the change.

10:26  
So initially this was my marginal cost curve, OK.

10:32  
And now what is happening?

10:34  
Higher yielding seeds, what do I, what does that mean?

10:37  
Well, it means that those seeds are more productive.

10:40  
Those seeds are more productive.

10:42  
We've seen with workers, we're just changing the label on them.

10:45  
The cost of producing that same extra quantity of sweet is lower than before.

10:56  
So my marginal cost curve is going to decrease.

11:01  
How much, I don't know without numbers, right.

11:04  
So we can't do how much on a graph, but we can kind of reasonably know it decreases, right?

11:09  
So this is my new marginal cost curve.

11:10  
Great.

11:12  
That's the curve that's changing.

11:13  
Then you put that first.

11:15  
Then you go back to your other fundamental cost.

11:18  
Fixed cost not changing.

11:19  
Good.

11:20  
But if my marginal cost is changing, it means that my variable cost is changing.

11:24  
It means that my average variable cost is changing.

11:28  
OK, so if this was my average variable cost to begin with, then my average variable cost is going to change.

11:34  
This becomes a little bit tricky.

11:36  
OK, now I've got to shift this average variable cost.

11:39  
Where exactly do I put it?

11:41  
Do I put it here?

11:43  
Do I put it up there?

11:45  
Depends on how you draw it.

11:46  
So every time you start asking yourself, OK, I don't know where exactly it goes, I have to think about it.

11:50  
Then that should be a flag in your head saying, OK, watch out because it could have shifted and I don't know exactly how it has shifted, OK.

11:59  
And then we put my total cost in there because if my average variable cost has changed, my average total cost has changed as well.

12:07  
I don't have the color.

12:09  
Let me just put it up here.

12:11  
Average total cost, right.

12:12  
My average variable cost has changed.

12:15  
My average total cost has changed.

12:18  
OK, so play around with This is the bed diagram, so I'm just going to draw it slowly.

12:23  
Carefully.

12:24  
Here's my marginal cost initial, marginal cost initial.

12:34  
Here's my average variable cost initial.

12:38  
Here's my average total cost initial.

12:42  
OK, now what is happening is my marginal cost is changing.

12:46  
That's my new marginal cost.

12:48  
That's your most fundamental thing.

12:51  
Once you have that, you know that your average variable cost is changing.

12:55  
Your average total cost is changing.

12:56  
You're going to move that to your new diagram, but that relationship between average and minimum still holds for before OK, at that same quantity, I know that my average variable cost is going to be lower, but where this point is, I don't really kind of know exactly.

13:15  
OK, but the minimum will always hit where ABC, minimum ABC is equal to MC.

13:23  
So whenever you do this, this is the first equation I want you to write down.

13:33  
This is the relationship between your costs.

13:35  
Start with your fundamental costs, always.

13:37  
Which ones of these are being affected?

13:40  
From there you trace out everything that's being affected, keeping in the back of your head the relationship between marginals and averages.

13:47  
And then you can figure out anything that's happening with your cost curves.

13:51  
Problems.

13:51  
That has lots of examples.

13:52  
I'm going to do some in class as well, so use the definitions to graph the various curves.

13:58  
OK, Identify the impact of the changes by going back to first principles.

14:03  
You don't need to add anything deeper than going back to module one.

14:06  
And remember that we're always looking at opportunity costs.