**W7 V1 Cost Classification**

0:09  
In this video we're gonna talk about the various types of costs and how to classify them.

0:14  
We'll introduce a bunch of jargon, but I will really try and focus on what the economic intuition and why we need these various costs.

0:23  
So forms are very simple.

0:24  
In our world, the only thing they care about is profits, which means that when we're solving the firm's problem, what we're trying to do is maximize profits.

0:31  
Profits, as you know, revenue minus costs.

0:34  
But remember, principle one, for economists, all costs, including from the firm side, are opportunity costs.

0:40  
Sometimes this is straightforward, sometimes there's a little bit of a subtlety.

0:43  
So let's think about carefully about what opportunity costs mean for a firm.

0:49  
With any opportunity cost calculation, the first thing you do is you kind of list out all of the resources that you use in your production.

0:55  
For example, I'm going to hire workers, right?

0:59  
I'm going to use labor more generally.

1:03  
But labor has two types, right?

1:05  
One is the workers that I hire in the market and I pay them kind of a wage and I don't own them.

1:13  
What I'm doing is I'm effectively renting their labor for the time period, but it could be also the owners labor, right?

1:24  
Or you can think about somebody else, like the CEO who may be slightly different from a worker in that they own particular parts of the company.

1:32  
OK.

1:32  
And the subtlety is going to be in this difference between resources that you own and resources that you rent.

1:38  
OK.

1:38  
So let's first start up with resources that we rent this.

1:40  
I'm using the example of Labor, but this can be any resource that you don't own but you rent on the open market.

1:47  
If you're renting on the on the open market, what you are doing is you're paying them.

1:52  
We're assuming the market wage, right?

1:55  
So if I want to figure out what the next best use of these resources are, their next best use will be, and I'm going to use next best alternative as NBA, Their next best alternative use is working for somebody else, right?

2:15  
So they could get another job.

2:18  
But the other job, presumably, if you've got competitive labor markets, pays them exactly the same wage, right?

2:27  
Same wage.

2:28  
So in that sense, if you want to value a resource that you rent on the open market at their opportunity cost, you're fine with using the wage rate, right?

2:38  
So you'll be like, OK, good, that's no problem.

2:40  
I'm going to value the opportunity cost at the wage rate.

2:45  
Problem comes in in a resource that I own.

2:47  
I'm using the example of an owner's labor, but you can also think about it.

2:50  
I have a truck that I'm my home truck that I'm just gonna use in the business or any resource that I own, but I'm actually using it in here.

2:57  
Now here's the problem.

2:58  
What's the next best alternative for a resource that I own?

3:02  
If you pay yourself a salary, you can say, well, that's the next best alternative.

3:07  
It's a salary I pay myself.

3:09  
No, because you are determining the value of your label.

3:11  
We don't want that.

3:12  
What we want is the value of your next best alternative and what else you could be using that label for, right?

3:20  
So in that sense, here you want to look for your next best alternative.

3:23  
Is that working for somebody else?

3:26  
Is that setting up a different business?

3:28  
Whatever it is, you want to scan for information that tells you the value of your labour at its next best alternative, and that is the number you put.

3:40  
Here's some examples, right You work for your father, and your father pays you $1,000,000, but you actually barely show up at work.

3:48  
Is that the value of your next best alternative?

3:50  
No.

3:50  
Steve Jobs used to pay himself $1.00.

3:52  
Was that the value of his labor?

3:54  
No, right?

3:55  
You always want to watch out for resources that you own or that appear free, because they're not always free.

4:04  
You want to look at the value of the next best alternative.

4:09  
Or more precisely, since I don't have space here, I'm going to say the opportunity cost using module one thinking right.

4:16  
So you go back to module one, you figure out your opportunity cost for your wage.

4:20  
That's the only subtlety here.

4:21  
That's different from module one.

4:22  
You've got to watch out for it.

4:23  
Because with firms, we're very tempted to just say what is the accounting profits and what is the accounting costs?

4:29  
No, everything.

4:30  
Principle one is opportunity cost, OK.

4:33  
Principle one is all costs are opportunity cost.

4:35  
Principle two comes in, OK, how do I determine how much a firm produces?

4:40  
So firms in our perfectly competitive markets, and we're still assuming perfectly competitive markets, firms do not choose price.

4:49  
They react to prices.

4:51  
Please, at this point, this should be deep in your brain, OK?

4:56  
Which means that if they do not choose prices, this they take is, given.

5:01  
This is not a choice that they make, OK?

5:04  
The only choice that they have is their choice of quantity.

5:08  
That's it.

5:09  
Which means that revenue is the price that's given to me.

5:12  
It's a flashing red sign.

5:13  
Quantity is something I choose.

5:15  
And costs, depending on my choices I make or depending on my opportunity cost, that's kind of something that could be particularly kind of under my control, but that's mostly coming through the quantity margin.

5:27  
OK, so now what principles do we use way back to Module 1?

5:31  
First, you always choose quantity, pretending you are producing right, You choose your quantity based on the price that you observe in the market.

5:40  
Come back, look at your costs, and find all of the units for which the price is at least as high as the marginal cost, and then you stop at the highest quantity.

5:51  
Then you take a step back and say, do I want to produce this quantity or not?

5:56  
Now when we think about decisions that our customer makes or a consumer makes, it's pretty straightforward, right?

6:01  
Buy this or not, buy this or not.

6:04  
But for a firm, what does produce or not mean?

6:06  
We'll be more precise when we say not producing means producing a quantity of zero, OK.

6:13  
There's going to be a small subtlety in long run, short run, but we'll go back to the next video, the last video, and we talk about that and much more in the next module.

6:22  
OK.

6:22  
So again, nothing new.

6:24  
We're just literally drawing on stuff that we brought in way back in module one.

6:28  
We're just kind of applying it to the problem of the firm, OK.

6:32  
Now if I want to do this, price is not within my control, but I do know what my costs are.

6:36  
So let's talk about what firm costs are keeping in mind or costs are opportunity cost.

6:42  
So eventually I want to build to total cost because eventually this is what's kind of new because we've talked a lot about marginal cost in the supply side.

6:51  
We've not really talked about this producer not decision for the produce or not decision.

6:56  
Suppose I've already done that marginal cost thinking and I figured out that that's the quantity I want to produce.

7:02  
What are my total costs?

7:04  
Now what we did so far as we've said, oh, you know what, think of this is the marginal cost.

7:09  
This is the price that they face in the market and these are all the units for which the price is at least as high as the marginal cost.

7:21  
So we've done that in here.

7:22  
And then we've said, well, thinking about the total cost is just one step ahead.

7:27  
This is the cost of the first unit, the second unit, the third unit, 4th unit.

7:31  
And then if I have continuous data, this is the cost of each tiny bit.

7:34  
I sum them all up in this area under the marginal cost curve is one thing that you can think of as being my total cost, right.

7:41  
So on one hand, it just seems a pretty straightforward extension of what we've done before and that's what I've got here, right.

7:50  
So far what we have done is to say, look, here's the marginal cost for every teeny tiny bit up to and including this quantity that I produce.

7:58  
And that's going to be what we're going to call a variable cost.

8:02  
So variable cost is not a fancy term.

8:04  
It's just a way for us to, in two words, convey this intuition that it is the sum of all the marginal cost for each and everyone of the units that we produce.

8:14  
Mouthful variable cost, just a way of capturing that.

8:17  
OK.

8:18  
So that's a new terminology that we have in here.

8:20  
Then again, we just want to be double sure we're not missing anything.

8:23  
So we ask, could there be any other costs apart from marginal cost that we're missing?

8:28  
And the answer is what you have accounted for in marginal cost is variable cost, which is things that change as the quantity that you produce changes.

8:38  
Produce one extra unit.

8:39  
Here's a marginal cost.

8:39  
It's gonna add to my cost 1 less unit and reduce my cost, right?

8:43  
It's changing as you produce more quantity or not.

8:47  
Could there be some costs that do not change with quantity?

8:50  
Right.

8:50  
So whatever you produce, you produce five, you produce 5 million, you produce zero.

8:55  
You have a fixed cost in that is a fixed amount that doesn't depend on the quantity that you produce.

9:03  
If you do have that, then you've got to add it into your total cost and get kind of the variable cost that's going to come from the sum of the marginal cost and any fixed component that you would not catch if you were just looking at variable cost, because that's just the changing stuff in there.

9:18  
That's the definition, all right.

9:20  
Again, there's nothing deep about this jargon.

9:22  
It's just a way for us in a few words to capture those thinking that we've already been doing in Module 1.

9:28  
So don't get caught up on the definitions.

9:30  
Think about what they are and then you don't have to worry about that anymore.

9:34  
OK, So that's fixed cost, variable cost and total cost, all kind of hidden inside The variable cost is the marginal cost, which we've been familiar with all the way from Module 1.

9:45  
Let's think a little bit more about marginal cost.

9:47  
Again, what's the definition of marginal cost?

9:49  
It's the cost to produce the extra teeny tiny bit of output.

9:53  
How do I calculate it?

9:55  
Well, what we did before, it's like it's a change in cost, right?

9:58  
So this was the cost of producing 1 unit.

10:01  
There's the cost of producing 2 units.

10:03  
The cost of producing the second unit will be the change in cost for that extra 1 unit.

10:09  
Now sometimes the data we have is not nice in that it goes 1234, sometimes the data goes, oh, you have 200 units and then you have 500 units and then you have 700 units.

10:22  
And it can kind of be very discrete jumps in there.

10:25  
When we talk intuitively, we tend to talk about it as one, but sometimes you have to work with the data.

10:30  
So when we have data that's not 1234, you want to look at effectively what we call like an average marginal cost, OK.

10:37  
Don't let the word average confuse you too much.

10:39  
It's just saying, look, if I take a big jump in quantity, you kind of want to make sure you're always making sure that you divide by quantity.

10:47  
So the total change in cost is still a rough marginal cost measure.

10:53  
It's not exact because we don't have data that's very, very, you know, continuous.

10:59  
But this is what you forget if you're not paying attention to how your quantity units change.

11:05  
OK, where does marginal cost come from?

11:08  
It comes from the fact that we've got extra output.

11:11  
Extra output needs extra inputs, and these inputs needs to be paid for.

11:16  
As these inputs can be changed, we call them variable inputs.

11:20  
Again, jargon tone, but all variable means is that you can change it.

11:25  
So if we've got inputs that can be changed, we are thinking about inputs that we need to hire more of, or if we want to scale back, cut them, fire them during a given time period to produce a thing.

11:38  
Variable inputs, The cost of that extra input will give me marginal cost, and for marginal cost I sum up all the marginal costs to give to get variable costs.

11:47  
If I have a fixed input, I have to pay for that input fixed amount.

11:53  
I cannot change it, which means that the payment is also fixed sometimes.

11:58  
There's a subtlety in here that it's sometimes fixed because of the time period we're looking at.

12:02  
So if I rented a space, I have to pay the rent for this month and I cannot change that the rental size.

12:09  
But maybe if you give me a few more months or when my lease is up, I can scale up to buy a bigger, rent a bigger space or scale down.

12:16  
OK.

12:17  
So careful about that because that's going to come in on the short run, long run.

12:20  
But if the size is fixed, if the size of the input is fixed and the cost is also fixed, so if you're looking at your data and you're like, where is this fixed and marginal, where is this marginal cost coming from?

12:30  
Where is this fixed cost coming from?

12:32  
You take a step back and look at the inputs because that is where your costs are coming from.

12:37  
Sometimes you're given data on inputs and you have to back out costs.

12:41  
Sometimes you're given data on total cost and you have to kind of work backwards and think about what inputs are and if you can back out any information about them.

12:49  
Let's talk about this in calculations, so hopefully you'll see that in a different way.

12:52  
Here's the information I'm given.

12:54  
I'm given that I have a firm that seems to be using only labour to produce output.

13:01  
OK, sometimes we have more information, but this is what I'm given, and this column here gives me the total labour that I use in order to produce this quantity of output.

13:11  
OK, how much does labor cost me?

13:13  
Well, I'm given the wage rate up there, so I know how extra, how much each extra unit of Labor cost me.

13:18  
Can I hire .0, you know, .8 units of Labor in our world?

13:24  
Yes, because typically we're thinking about averages over weeks.

13:27  
Or this could be representing .8 of 1,000,000 workers, or 1000 workers.

13:33  
Don't worry too much about that.

13:34  
But we always assume integer values are possible.

13:37  
Now the other thing we want to scan for is other inputs that I need to pay for that are not variable that cannot be changed but are fixed.

13:46  
And in here I'm telling you that the firm has to pay $15.00 as a fixed fee.

13:51  
So scan for the information and the other, the missing ones are what I need you to calculate.

13:56  
So we use the definition and start somewhere.

13:59  
So the easiest way always is to start with a fixed cost, because you know the fixed cost doesn't change with the amount you produce.

14:07  
So whether I produce one or whether I produce 5 or whatever I produce, I still have to pay the $15.00 of my fixed fee.

14:16  
But notice, even if I'm not producing anything, the assumption is I still have to pay the fixed cost as well.

14:25  
OK, be careful about this.

14:26  
There can be subtleties in here.

14:28  
In fact, when we talk about long run and short run, this subtlety is going to be a little bit more important.

14:33  
But for now, in the example that we're doing, I'm going to assume that I'm paying it even when it's zero.

14:37  
OK, variable cost.

14:39  
Now when I produce nothing, I don't hire any labour.

14:42  
So that there's no kind of variable cost in here, you can put it as 0.

14:46  
But when I produce one unit, I have got to hire .8 workers and I got to pay them $10, which means that my variable cost, total variable cost of producing 1 unit is 8.

14:58  
Marginal cost is a change in variable cost, right?

15:02  
We summed up marginal cost to get variable cost.

15:06  
But if I've got a variable cost here, I've got this area, and this is my variable cost.

15:12  
And now I'm saying I'm producing an extra unit and that's what it's going to cost me.

15:17  
And change in variable cost is your marginal cost right?

15:19  
Be flexible enough to switch with both not putting in a number there because we're going to do it separately.

15:25  
But you can fill in all of these numbers here using the definition of the variable input, giving you variable cost, total cost, summing up both of them, right?

15:40  
And so on and so forth.

15:42  
Marginal cost, as we've just talked about, is the cost of producing the extra input.

15:47  
Previous slide we defined it as the change in total cost.

15:51  
Sure, OK, good.

15:52  
There is no such thing as marginal cost for 0 because I'm not producing anything.

15:56  
But when I go from zero to 1, the cost of the extra input is $8.

16:04  
It's the change in total cost.

16:07  
Notice also it's the change in variable cost.

16:11  
OK, well, I'll show you an equation again how you can understand that.

16:15  
But once you have your fixed cost and your marginal cost, right, or your fixed cost and your variable cost, you can kind of fill in all of the rest using the definitions.

16:24  
You don't need to memorize any formulas, just using the definitions of those costs.

16:29  
OK.

16:29  
So this is kind of the data that I have in here.

16:34  
Now here is how I want you to think about it.

16:38  
Rather than memorizing anything, the best way to do it is to think about your two fundamental costs.

16:43  
Everything that we've talked about goes with the basic principles.

16:47  
Principle one, every cost.

16:48  
When I say the word cost, cost, cost, I mean opportunity cost.

16:52  
2.

16:53  
The fundamental cost in principle two is marginal cost.

16:55  
So that is the first basic cost you're starting out with.

16:58  
OK.

16:59  
The second one is sometimes variable cost.

17:02  
Your marginal cost don't capture other costs like a fixed cost.

17:06  
When you start off with this, you get all of your costs because marginal cost will give me variable cost.

17:14  
Some of the marginal cost, Fixed cost plus variable cost gives me total cost.

17:23  
So with these two fundamental building blocks, you can back out anything.

17:27  
If I have some data in those other parts, I can back out the other ones, be flexible enough to move back and forth within all of them.

17:35  
But when you're doing any analysis, I want you to start here or if you have other data, back out those two fundamental costs and then start from there.

17:43  
OK.

17:44  
So variable cost, some of the marginal cost will looks fancy, but all that is saying some of the marginal cost, total cost, fixed cost and variable cost.

17:54  
Please don't forget about the fixed cost.

17:55  
Sometimes they're there, sometimes they're not, but you mentally should always be checking for them.

18:01  
OK, So now I said you've got to be flexible moving back and forth between working from marginal cost to total cost, but also from total cost to marginal cost.

18:12  
So in one sense, if I have total cost, I just look at the change in total cost.

18:17  
So here's the total cost of producing Q bar, which is the fixed cost plus the variable cost of producing Q bar minus what it cost to produce the previous unit.

18:28  
Fixed cost plus variable cost of the previous unit.

18:35  
OK, that difference is what's going to give me marginal cost.

18:38  
So if I just have total cost, I can use a total cost change to figure out marginal cost.

18:43  
But notice also with this equation, if I open it up, it is effectively the change in the variable cost, right?

18:57  
So I can use change in total cost to find marginal cost.

19:00  
I can use change in variable cost to also find marginal cost.

19:04  
And that's when this flexibility in the use of definitions will help you figure out the cost you have from whatever limited information you're given.

19:13  
We are going to use average costs a lot.

19:16  
OK?

19:17  
Now when we introduce average costs, students immediately think it has some value.

19:22  
And so what's the cost on average?

19:24  
Because that's information for what a firm should do.

19:28  
And here I want you to take a step back and be clear about why we use average costs.

19:34  
We use average costs as a short form for our graphs.

19:38  
OK?

19:39  
And I'll explain that more.

19:40  
When we have cost curves, we do not use average cost because there's something specific about an average cost to make a decision.

19:47  
What we are doing is using it as a shortcut that allows us to put information on a graph in a manner that's very easy to use.

19:55  
OK, So that's why we use average cost.

19:58  
Please do not start thinking average cost is separate from those 3 principles.

20:03  
It's not.

20:03  
It's a way for us graphically to quickly determine what a firm should do using those three basic principles.

20:10  
But because we are using averages on our graphs, let's talk about the definitions.

20:14  
Definitions of an average.

20:15  
Pretty straightforward, right?

20:16  
Average variable cost.

20:18  
Take your total variable cost divided by the quantity.

20:21  
Take your fixed cost divided by the quantity to get average fixed cost, total cost, total cost divided by the quantity, right.

20:29  
That's it.

20:29  
There's nothing deeper to that.

20:31  
It's just a way that we can use it for our graphs.

20:35  
OK, the take that same information I gave you on a previous slide and calculate your averages.

20:43  
Now the reason I'm asking you to do this is because sometimes students here make a mistake in the following sense.

20:51  
If I have just one unit, then it students are pretty OK with that.

20:54  
Fixed cost by 1, variable cost by 1, total cost by one.

21:01  
If I ask students what's the average fixed cost when we have 4 units, they forget that I'm asking them for four units.

21:09  
So you always have to divide it by the quantity that you are interested in.

21:14  
This is not any, you know, random quantity.

21:17  
This is saying at when I produce 4 units, what's my average cost?

21:21  
Which means that I'm going to take my $15 and I'm going to spread it over all of those 4 units that I have.

21:27  
Same thing here, 23 four units that I have and with total missing.

21:33  
This is where the most common source of errors on the exam comes in.

21:37  
But if you remember what an average is, you should not get caught by this.

21:44  
OK, so let's go back to the firm's problem.

21:46  
All costs are opportunity costs.

21:48  
They're worried about their profits.

21:49  
So we've got to take think about opportunity costs first.

21:52  
They choose their quantity based on price versus marginal cost.

21:56  
And let's say that they've decided that that's the quantity that they're interested in producing.

22:01  
OK.

22:01  
So they figured that out.

22:02  
Now should they decide produce or not?

22:04  
And then you're like, oh, I know how to do this.

22:07  
I've remembered about my fixed cost in there.

22:09  
I've calculated my total cost.

22:11  
And now I'm going to make sure that total benefit, which here is total revenue, is at least as high as my total cost.

22:17  
And I'm going to say, yes, fantastic, small caveat that you need to watch out for some costs and it's a lot of information for this video.

22:25  
So I'm going to hold off until we get to the long run, short run video, so you can see how we use that.

22:31  
But please, this should be like a red flag in your head.

22:34  
Yes, we think about total cost, but there's some subtlety about fixed cost in here.

22:39  
And come back and fix this when you really see it in the next module.

22:44  
OK.

22:46  
All costs are opportunity costs.

22:47  
Please start with that.

22:48  
You tend to forget that because you're more comfortable doing that with people.

22:51  
And you think firms are different.

22:52  
They're not.

22:53  
They're just people in the sense of opportunity costs.

22:56  
And we follow the same procedure, watching out for resources that you own.

23:00  
OK, Use the information, the relationship between the costs and the information given to back out what you need from what you have.

23:09  
That flexibility is really important if you don't need to memorize formulas.

23:13  
You just need to understand what these costs are.

23:15  
OK.

23:16  
And average costs are useful for us for graphs, which we will see in the next video.