The following minutes to cut

00:00-12:18

12:48-13:20

22:20-22:59

24:19-26:00

26:39-26:52

28:34-29:05

29:23-30:21

31:09-31:20

36:15-37:02

So exponential smoothing, what is exponential smoothing? Exponential smoothing is a moving average, a wider moving average. What is moving average?

Say we have data, 100 period, 200 period, something.

We have 100, 200, 1000 numbers or periods. Someone ask us "What is your forecast for the next period?" I say "I will add up all the numbers I have and average it, that is my forecast for the next period. So I have been very conservative here, I try to satisfy everybody and find if all the demand are correct what's the average for the next period's demand?

That is one extreme. On the other extreme we just may take the last and say "I only rely on the newest piece of data and my forecast for the next period'

Moving average is a mediation, a sort of compromise between these 2 extreme points. Instead of relying on the last period, I rely on the last two periods. Instead of two periods I rely on three. That's three period moving average.

The larger the number of periods the smoother the data and the less the impact of the last period. This is 100%.

Do not forget, we don't want you to memorize this. When you go to class I may throw some data to you, some facts. We may transform those data into information. Then we make a little more play with those information and transfer those information to knowledge. We may play with that knowledge and transfer our understanding.

We may play with that then. The more prepared you are in class, the more opportunity we have to go from memorizing things to applying them. That is the whole idea.

So in an end period moving average I try to find an appropriate place in the continuum between relying on all pieces of data and relying on the last piece.

My measure of effectiveness is MAD. Having said that, now I can think about something else. I may say my forecast for the next period, which is period T+1 is equal to my forecast for the previous period plus a fraction of the difference between what my forecast was and what I observe. [writing on board]

So this is what my forecast was [On overhead.] This is what I observed in reality [On overhead.]

If I'm going to take all of that difference, 100% of that difference, what will I have? I will have Ft+(At−Ft)

What is left is At. If I set alpha to 1 period moving average .. if I put *α* =0then 0 is multiplied by this. No matter what the reality is I won't make any change. My forecast for this period is exactly what it was for this period.

I am moving from somewhere which 100% relies on last period, and something which does not rely at all on the last period. The question is where is the best place to stay? How much should I give attention to the demand of the last period and it's derivation from my forecast. So *α* is defined as a variable between 0 and 1. If it's 1 my only focus is on the last period. If it's 0 I have no respect for the last period. I don't incorporate any new knowledge into my forecast.

If it is 0.5 that means last period my forecast was 100, the actual demand came out 120, which is 100 units more, there's a 20 unit difference. I don't take 100% of that and incorporate it. I take 50%. Okay? That is how exponential smoothing works.

Therefore exponential smoothing forecast for the next period equals ... [On overhead.] Any questions?

I can simplify this equation, I can multiply *α* for Atand I can also multiply this [On overhead.] Then I can put it together. [writing on board.]

This is another formula for exponential smoothing.

Exponential smoothing can be forecast as [writing on board]

When alpha goes up, this part goes up, this part goes down. This means I pay more attention to recent periods. If alpha goes down I pay more attention to this. As I explained my lecture, the exponential smoothing is a moving average where all pieces of data are taken into account. However it's weighted. The weight of all elements are low? Okay.

[On overhead.]

Again we put numbers into formula. [ reading from the overhead ] Any questions?

Okay. [Teacher reading: Question 3]

We know the actual for this period is ... 16000. So I can put this actual and forecast into formula ... sorry, what? This is our forecast for period 4, 16000. *α* =0.4.

So I have the forecast for period 4, forecast is given, alpha equals 0.4, I put it into the formula and I get 17600Okay?

Now I have actual and forecast for period 5, then I compute the forecast for the next year. [On overhead.]

Professor: Again, same formula. [Teacher reading: Question 4.] Question put this into the formula to compute.

Professor: The previous forecast was 66, 5 units larger than the actual demand. So this is exponential smoothing formula. The previous forecast was 66, which was 5 units larger than the actual demand. This was 66 and it was 5 units greater than ... 5 units larger than actual demand. So actual - forecast = -5right?

Professor: The previous forecast of 66 turned out to be 5 units larger. [ reading from the overhead ]

Our forecast for next period is 65. Therefore we do 65=66+-5

*α* =0.2

Any questions? Any questions?

Female Student: Do we always keep it like that? With the negative?

Professor: It can be positive, it could be negative. What it says here, the previous forecast ... is Ft. The previous actual is At

Previous forecast was 66, which was 5 units larger than actual. If that is difficult you can assume this ... forecast was 5 units larger than actual.

If forecast was 5 units larger than actual, 66. Therefore forecast was that.

So we use those 5 units to compute 61, but we don't need to do that.

If we subtract them, this is 5 units more than this, so a negative sign. Right? Then we have one equation, one unknown. *α* =0.2

[Teacher reading: Question 6]

Forecast error is A−F. So previous forecast is F. So a percentage of A−F and define it as exponential smoothing. Exponential smoothing is new forecast equal to old forecast + alpha times actual.

[Teacher reading: Question 6]

Is which? It is D. Any objection?? Next question?

When you use large numbers you give more values to recent period observation. If you give small that means you give less value to the most recent observation and more value to all before this, right?

Exponential smoothing, we want one period moving average. [ reading from the overhead ] that is what we want. Therefore what we want is this to become 0 and this to become 1. If I set *α* =1 then 1− *α* =0. Right? Any questions?

What is the answer is that? Question 9.

This is a straight line, no matter if forecast is 0 or 7000, I stay as I was before. [ reading from the overhead ] This part becomes 0. [On overhead.]

Okay?

Now we have 7 periods of data and we want to use 5 period moving average, exponential smoothing and compute MAD and compare. Usually when we do forecasting, that's what you will do in the game is you draw the data to see if you observe a pattern. Right? Then we try to find via an appropriate method, which minimizes this.

This is our data [On overhead.] We don't see any specific pattern. 7 pieces of data. We use 5 period moving average. We will not be able to compute 5 period moving average until period 5.