Moving averages

1.

First, let's set up a new worksheet for our analysis.

- Create a new *worksheet* and name it "Forecasting".
- Insert a new table in A1 and name it "Forecast".

Hint

To add the new worksheet:

- Click on the + on the bottom ribbon to add another *worksheet*.
- Double-click on the new *worksheet* tab and type "Forecasting". To insert the new table:
- Click on *Table* under the *Insert* ribbon and click *OK*.
- Type in "Forecast" for the *Table Name* under the *Table Design* ribbon.

2.

Now let's create a table and sum the total sales from the Account Sales History table.

- Name Column A "Sales Month" and display dates ranging from 7/1/2019 to 7/1/2021.
    - This gives us an extra month that we'll use to forecast
- In Column B of the Forecast table, create a new column called "Total Sales" and sum the Sales Amount for each Sales Month, using SUMIF().
- Format Column B as a $ with 0 decimals

Hint

- The `Total Sales` formula should look like this:
- `=SUMIF(Sales[Sales Month],____,Sales[Sales Amount])`.

3.

A **simple moving average (SMA)** forecast uses the average values over the previous periods to predict the current period.

- Add a new column called "SMA Forecast" to the Forecast table in Column C.
- Starting in the 5th row of the *worksheet*, use AVERAGE() to calculate a **simple moving average** forecast that uses the previous **three** months.
    - For example, if the period is 10/1/2019 then it should average the Total Sales between 7/1/2019 and 9/1/2019
- Fill this formula down.

Hint

- The SMA Forecast should look like this:

AVERAGE(____:____)

- Since the forecast is averaging the previous three months, the calculation should be placed in the row for 10/1/2019 and should average the Total Sales between 7/1/2019 and 9/1/2019.

4.

A **weighted moving average (WMA)** gives different weights to different periods, usually giving a higher weight to more recent periods because that data is considered more relevant.

- Add a new column called "WMA Forecast" to the Forecast table in Column D.
- Starting in the 5th row of the *worksheet*, calculate a **weighted moving average** forecast that uses the previous **three** months and use these weights:
    - 1st month total sales: 15%
    - 2nd month total sales: 35%
    - 3rd month total sales: 50%
- Fill this formula down.

Hint

- The WMA Forecast formula should look like this: =B2*15%+____*35%+____*____
- Since the forecast is averaging the previous three months, the calculation should be placed in the row for 10/1/2019 and should average the Total Sales between 7/1/2019 and 9/1/2019.

5.

What does the weighted moving average forecast predict Total Sales to be in 7/1/2021? Round your answer to the nearest dollar (i.e., $10,000)

$73491

Hint

- Starting in C5, the SMA Forecast should be:

=AVERAGE(B2:B4)

- Starting in D5, the WMA Forecast should be: =B2*15%+B3*35%+B4*50%

If you're still stuck, review the solution in 4_1_moving_averages.xlsx from the Workbooks folder.

Trendline forecasts

1.

The *linear trendline* draws a straight line through our graph, and *Excel* uses a regression analysis to find the best fitting line between all the values.

- Insert a *line graph* over the Sales Month and Total Sales data between 7/1/2019 and 6/1/2021.
- Add a *Linear Forecast* for 6 months.
- Show the equation being used for the trend line.

Hint

To create a line chart with a linear forecast:

- Select the relevant data from Sales Month and Total Sales and click on the *Insert* ribbon.
- Navigate to the *Charts* section and click the *Insert Line or Area Chart* icon.
- Under *Chart Design*, click *Add Chart Element* > *Trendline* > *Linear Forecast*. To modify the forecast length:
- Double click on the *trendline*.
- Set *Forward* to 6 periods.
- To display the equation, check the box for *Display Equation on chart*.

2.

Logarithmic trendlines best-fit data that change quickly to start, then slow down and level off at the end. This could be a rapid increase or decrease pattern that slows in later periods.

- Set the trendline to *Logarithmic* to see how it looks.

Hint

- Open the trendline options pane by double-clicking on the trendline in the graph.
- Under *Trendline Options* click *Logarithmic*.

3.

Next, let's look at the *polynomial* option. In algebra, "poly" means many, and "nomial" means term, so together, polynomial means many terms (or more than one). The more *Orders* we add to the options, the more "nomials" are added to the forecast equation. This means the forecast can become flexible to fit over the bends in the graph, although beware! Too many orders will overfit the graph and give an unrealistic number.

- Set the trendline to polynomial.
- Increase the orders to see how the *trendline* and equation change.

Hint

- Open the trendline options pane by double clicking on the trendline in the graph.
- Under *Trendline Options* click *Polynomial*.

4.

The amount of information we analyze in a forecast matters and can bias our data. For example, since our sales data is close to $0 for the first six months, and then begins to rapidly grow, this could cause bias in the forecast because the old information is no longer relevant to the new information.

- Change the data range of the *line chart* to analyze the last 12 months of sales (7/1/2020 to 6/1/2021).

Hint

- Double click on the *Line chart*
- Adjust the data range by dragging the boxes so that the Sales Month and Total Sales data are captured for 7/1/2020 to 6/1/2021

5.

Notice that adjusting the dates made our trendline change.

- Review the linear and polynomial trendlines again to see what they look like now.

Hint

- Open the trendline options pane by double clicking on the trendline in the graph.
- Under *Trendline Options* adjust the trendline option between *Linear* and *Polynomial* to see the differences.

6.

Notice that moving our dates also allowed for the *Exponential* option. An exponential trendline is best for lines with a smooth curve constantly increasing or decreasing at a faster and faster pace.

- Set the trendline to *Exponential* and see what happens.

Hint

- Open the trendline options pane by double clicking on the trendline in the graph.
- Under *Trendline Options* click *Exponential*.

7.

Which one of these trendline options has the best fit?

- Exponential
- Linear
- Polynomial with 3 orders
- Logarithmic

Hint

- The Total Sales formula should look like this:

=SUMIF(Sales[Sales Month],[@[Sales Month]],Sales[Sales Amount])

- Click on the trendline to open the *Trendline Options* pane.

If you're still stuck, review the solution in 4_2_trendlines.xlsx from the Workbooks folder.

Forecast Sheet

1.

Use the *Forecast Sheet* tool to create a new forecast.

- Create a *Forecast Sheet* using Total Sales between 7/1/2019 and 6/1/2021.
  - Make sure to include the headers.
- Have the forecast start on 6/1/2021 and end on 12/1/2021.
- Confirm that the confidence interval is set to 90% and the *Seasonality* is set to *Detect Automatically*.

Hint

- Highlight the range for Sales Month and Total Sales for the months between 7/1/2019 and 6/1/2021.
- Click on *Data* > *Forecast Sheet*.
- Open the *Options* dropdown and then set the *Forecast Start* to 6/1/2021.
- Set the *Confidence Interval* to 90% and the *Seasonality* to *Detect Automatically*.

- Click *Create*.

2.

This created a new worksheet with a table and a *line graph*.

- Rename the new sheet to "Forecast Sheet".
- Rename Forecast(Total Sales) to "Forecast 1".
- Rename Lower Confidence Bound(Total Sales) to "Lower Bound 1".
- Rename Upper Confidence Bound(Total Sales) to "Upper Bound 1".

Hint

- Double-click on the headers to rename them.

3.

Remember that the date range can be biased by anchoring our numbers to older trends that may not follow newer patterns. Let's check to see if this is happening in our data.

- In column F create a new column called "Forecast 2".
- Set F25 to equal to the actual Total Sales value.
- Starting in F26, create a formula that calculates values using FORECAST.ETS(), using data from 7/1/2020 through 6/1/2021.
- Fill out the column from 7/1/2021 to 12/1/2021.

Tip: Keep the cell references locked so they don't move when filling in formulas! You can lock a cell range by clicking F4 on your keyboard.

Hint

- The formula for Forecast 2 should look like this: =FORECAST.ETS(A26,____,____,1,1).
- The formula for Lower Bound 2 should look like this: =____-FORECAST.ETS.CONFINT(A26,$B$2:$B$25,$A$2:$A$25,____).
- The formula for Upper Bound 2 should look like this: =____+FORECAST.ETS.CONFINT(A26,$B$2:$B$25,$A$2:$A$25,____).

4.

- In column G create a column called "Lower Bound 2".
- In column H create a column called "Upper Bound 2".
- Set Row 25 in each column equal to the actual Total Sales value.
- Starting in Row 26, create the lower and upper confidence bounds at 95% using FORECAST.ETS.CONFINT().
- Fill out these columns for 7/1/2021 to 12/1/2021.

Tip: Keep the cell references locked so they don't move when filling in formulas!

Hint

- The formula for Lower Bound 2 should look like this:

=____-FORECAST.ETS.CONFINT(A26,$B$2:$B$25,$A$2:$A$25,____)

- The formula for Upper Bound 2 should look like this:

=____+FORECAST.ETS.CONFINT(A26,$B$2:$B$25,$A$2:$A$25,____)

5.

That didn't seem to do much to our numbers, so thats a good sign that there is no anchoring bias present in our data. Currently, our forecast is only for the next 6 months. Let's extend the duration of our forecast to 12 months, ending in 6/1/2022.

Hint

- Add new rows for the months 1/1/2022 through 6/1/2022.
- Drag the formulas down for each of the columns.

Did you find this feedback helpful?

6.

Finally, let's update the *line graph* to reflect all our changes and make it look nice.

- Update the data range so all the new columns and rows are included.
- Edit the lines on Forecast 1 and Forecast 2 to be dots.
- Edit the lines on Forecast 2, Lower Bound 2 and Upper Bound 2 to all be the same color.

Hint

- Click on the *Chart Design* ribbon > *Select Data*.
- Select the entire table for the *Chart data range*.

7.

Based on all of this, which forecast should we use?

- Forecast 1 because it has a lower confidence interval, and it is therefore more precise.
- Forecast 2 because it has a higher confidence interval, and therefore it encompasses more possible outcomes.
- Forecast 2 because it has a higher estimated value.
- It depends....

Hint

- The final formula for Forecast 2 should look like this:

=FORECAST.ETS(A26,$B$14:$B$25,$A$14:$A$25,1,1)

- The final formula for Lower Bound 2 should look like this:

=[@[Forecast 2]]-FORECAST.ETS.CONFINT(A26,$B$2:$B$25,$A$2:$A$25,0.95)

- The final formula for Upper Bound 2 should look like this:

=[@[Forecast 2]]+FORECAST.ETS.CONFINT(A26,$B$2:$B$25,$A$2:$A$25,0.95)

If you're still stuck, review the solution in 4_3_forecast_sheet.xlsx from the Workbooks folder.