SumProduct

NEWSLETTER #75 - February 2019
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The closest many modellers get to a date is with one of Excel's three **DATE** functions – we cover them all this month.

In this newsletter, we also look at one of Excel's lesser-used features, Data Tables, to show you how to use them and note the traps to avoid. We also cover off the January updates this month (of which there were quite a few) for various variants of Power BI.

With our regular series on Power Pivot, Power Query, Power BI Updates, VBA, Keyboard Shortcuts and the ever-accumulating A to Z of Excel Functions, it's another edition where you get your money's worth (yes, I know this is free!).

Until next month.

Liam Bastick, Managing Director, SumProduct

Data Tables

This month, we though we'd take a look at "what if?" analysis and a feature that a surprising number of users do not appear to know. This may help with **sensitivity analysis**, by which we mean the flexing of one or at most two variables to see how these changes in input affect key outputs. This may be performed using Excel's built-in **Data Tables**.

Data Tables are ideal for executive summaries where you wish to show how changes in a particular input affect a key output. However, you should use them sparingly. If you can achieve the same functionality without using Data Tables, then you should do that:

	A	B	C	D	E	F
1	**Example Without Data Tables**					
2						
3		**Revenue**				
4						
5			Revenue	20,000		
6						
7						
8		**Summary Table**				
9						
10			**Flexed by**	**Revenue**		
11			5.0%	21,000		=$D$5*(1+$C11)
12			10.0%	22,000		=$D$5*(1+$C12)
13			15.0%	23,000		=$D$5*(1+$C13)
14			20.0%	24,000		=$D$5*(1+$C14)
15			25.0%	25,000		=$D$5*(1+$C15)
16			30.0%	26,000		=$D$5*(1+$C16)
17			35.0%	27,000		=$D$5*(1+$C17)
18			40.0%	28,000		=$D$5*(1+$C18)
19			45.0%	29,000		=$D$5*(1+$C19)
20			50.0%	30,000		=$D$5*(1+$C20)

In this illustration, the key output revenue has been given in cell **D5**. We want to summarize what happens if we increase ("flex") this figure by a given percentage, with the inputs specified in cells **D11:D20**. This can be simply computed by using the formula

=$D$5*(1+$C11)

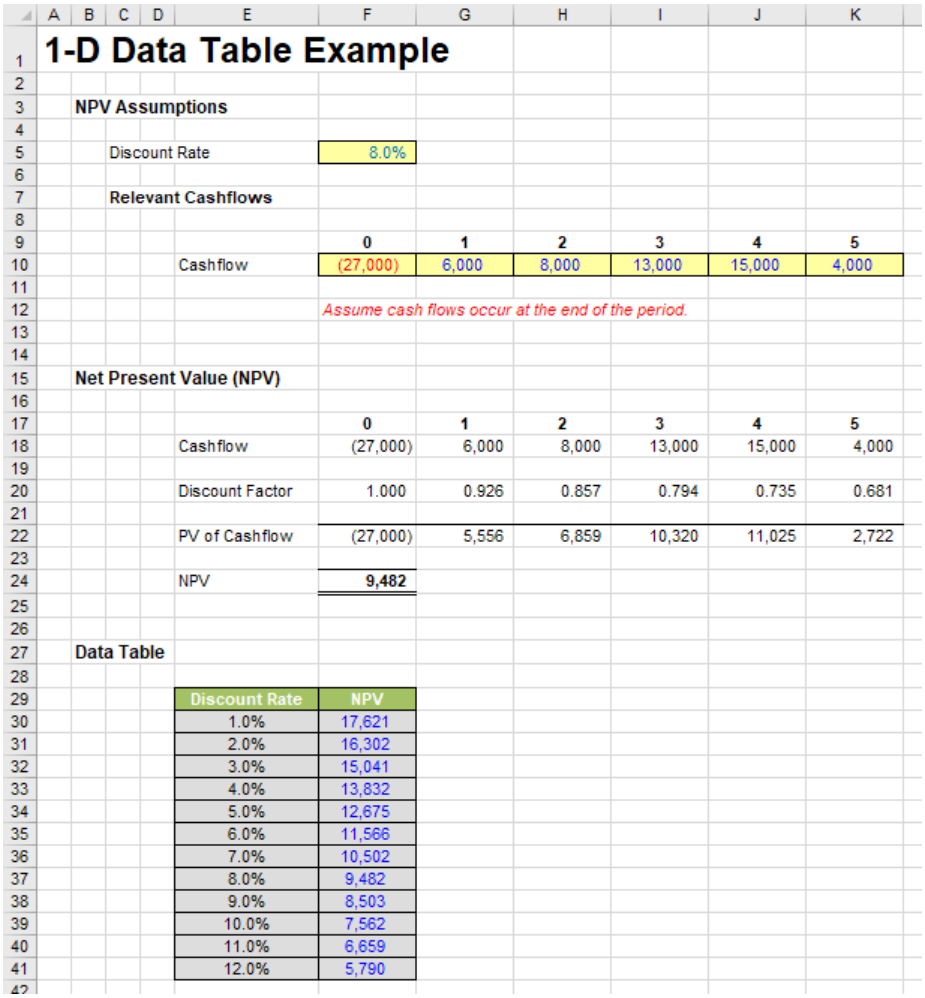
in cell **D11** and simply copying this calculation down.

Data Tables should really be used when such simple calculations are not possible and you want to flex one variable (known as a "one-variable" or "one-dimensional (1-D)" Data Table) or two (known as a "two-variable" or "two-dimensional (2-D)" Data Table).

Let's take a look at each in turn.

1-D Data Tables

This is best illustrated using another example:



1-D Data Table Example

NPV Assumptions

Discount Rate	8.0%

Relevant Cashflows

	0	1	2	3	4	5
Cashflow	(27,000)	6,000	8,000	13,000	15,000	4,000

Assume cash flows occur at the end of the period.

Net Present Value (NPV)

	0	1	2	3	4	5
Cashflow	(27,000)	6,000	8,000	13,000	15,000	4,000
Discount Factor	1.000	0.926	0.857	0.794	0.735	0.681
PV of Cashflow	(27,000)	5,556	6,859	10,320	11,025	2,722

NPV **9,482**

Data Table

Discount Rate	NPV
1.0%	17,621
2.0%	16,302
3.0%	15,041
4.0%	13,832
5.0%	12,675
6.0%	11,566
7.0%	10,502
8.0%	9,482
9.0%	8,503
10.0%	7,562
11.0%	6,659
12.0%	5,790

It's not vital you understand what this spreadsheet is doing. It is essentially using inputs in cells **F5** and **F10:K10** to generate an output in cell **K24**, as it calculates what cash received in row 10 would be worth now if interest were 8.0% per period (known as the "Net Present Value" (NPV)).

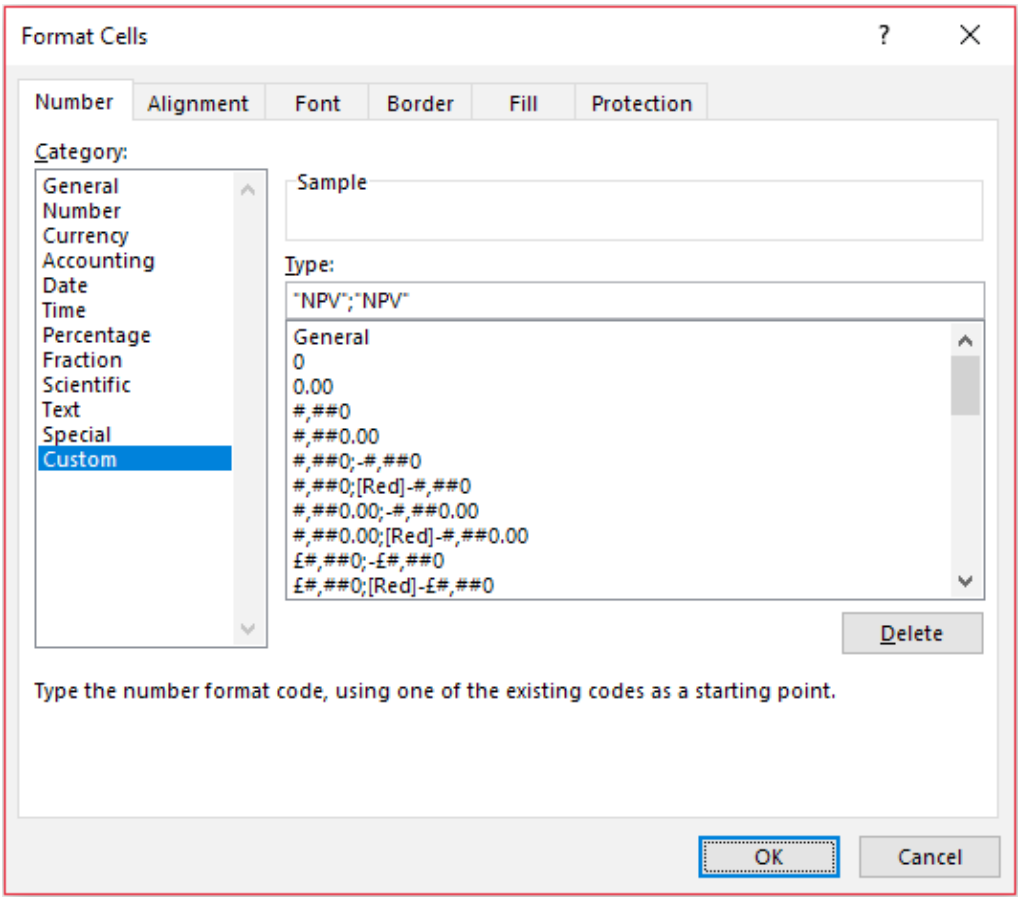
Now, for more sophisticated readers, yes, I appreciate this example could be constructed using a similar technique to our revenue example using the **NPV** function: I just wanted to construct a slightly more complex alternative that could still be followed!

Therefore, with a simple Net Present Value calculated for a total of six periods (0 to 5 inclusive), the output for a discount rate of 8.0% (cell **F5**) is +$9,482 (cell **F24**). But what if I wanted to know how the NPV would change if I varied the input discount rate?

It is very easy to construct a table (a Data Table) similar to the one displayed in cells **E29:F41** above. The required discount rates are simply typed into cells **E30:E41**, but the heading in cell **F29** is not what it seems.

For a 1-D Data Table to work using a columnar table similar to the one illustrated, the top row of the second and any subsequent columns has to contain the reference to the output cell(s). Many modellers will do this, putting the headings in the row above instead and then they may or may not hide this row in order to compensate.

There is a crafty alternative (employed above). Using **Ctrl + 1, Alt + H + O + E** or select 'Format Cells…' from the 'Format' drop-down in the 'Cells' grouping of the 'Home' tab of the Ribbon to Format Cells. Then, if we go to the 'Number' tab we can still type the formula(s) in but change the outward appearance of the cell. It is with this borne in mind that cell **F29** is formatted as follows:

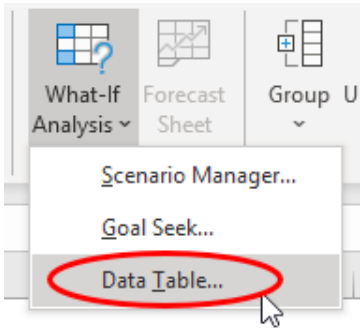


Here, I have typed in ""NPV";"NPV". We've discussed custom number formatting before. Essentially, what I have done here is replaced all non-negative numbers with the text "NPV" and negative numbers with the text "NPV". You might wonder why I have I typed this in twice? If the number is negative and the second "NPV" has not been defined the negative number would be replaced by "-NPV" instead – which is not what we want.

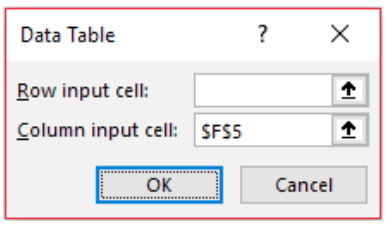
Once this formatting has been done and the formula

=F24

has been typed into the header in cell **F29** (giving it the appearance "NPV", then select cells **E29:F41** and go to 'Data Table…' in the What-If Analysis drop-down list in the 'Forecast' grouping of the 'Data' tab on the Ribbon (**ALT + D + T**):



This calls the 'Data Table' dialog box:



At this point, confusion often sets in as users are often unsure whether they should be entering details in the 'Row input cell:' and/or 'Column input cell:' input boxes. The rules are very simple:

- Referenced directly, the inputs and outputs must be on the same sheet as the Data Table (although there are ways and means around this)
- Use only one input box if you want to flex one input; use both if you wish to flex two
- If inputs are in a **column** in the Data Table, use the '**Column input cell:**' input box
- If inputs are in a **row** in the Data Table, use the '**Row input cell:**' input box.

Here, my inputs are in a column and I want to use them to substitute for the value in cell **F5** so I select cell **F5** for the 'Column input cell:' input box. Clicking 'OK' results in the following summary:

	A	B	C	D	E	F	G	H
26								
27		Data Table						
28								
29					Discount Rate	NPV		
30					1.0%	17,621		{=TABLE(,F5)}
31					2.0%	16,302		{=TABLE(,F5)}
32					3.0%	15,041		{=TABLE(,F5)}
33					4.0%	13,832		{=TABLE(,F5)}
34					5.0%	12,675		{=TABLE(,F5)}
35					6.0%	11,566		{=TABLE(,F5)}
36					7.0%	10,502		{=TABLE(,F5)}
37					8.0%	9,482		{=TABLE(,F5)}
38					9.0%	8,503		{=TABLE(,F5)}
39					10.0%	7,562		{=TABLE(,F5)}
40					11.0%	6,659		{=TABLE(,F5)}
41					12.0%	5,790		{=TABLE(,F5)}

That's it – you have your "What-if?" analysis. It should be noted that at this point you may not enter any rows or columns into the Data Table (or delete any either). This is because the formula

{=TABLE(,F5)}

has been entered into cells **F30:F41**. The braces ('**{**' and '**}**') may not be typed in. These are special characters created by Excel when you type the formula

=TABLE(,F5)

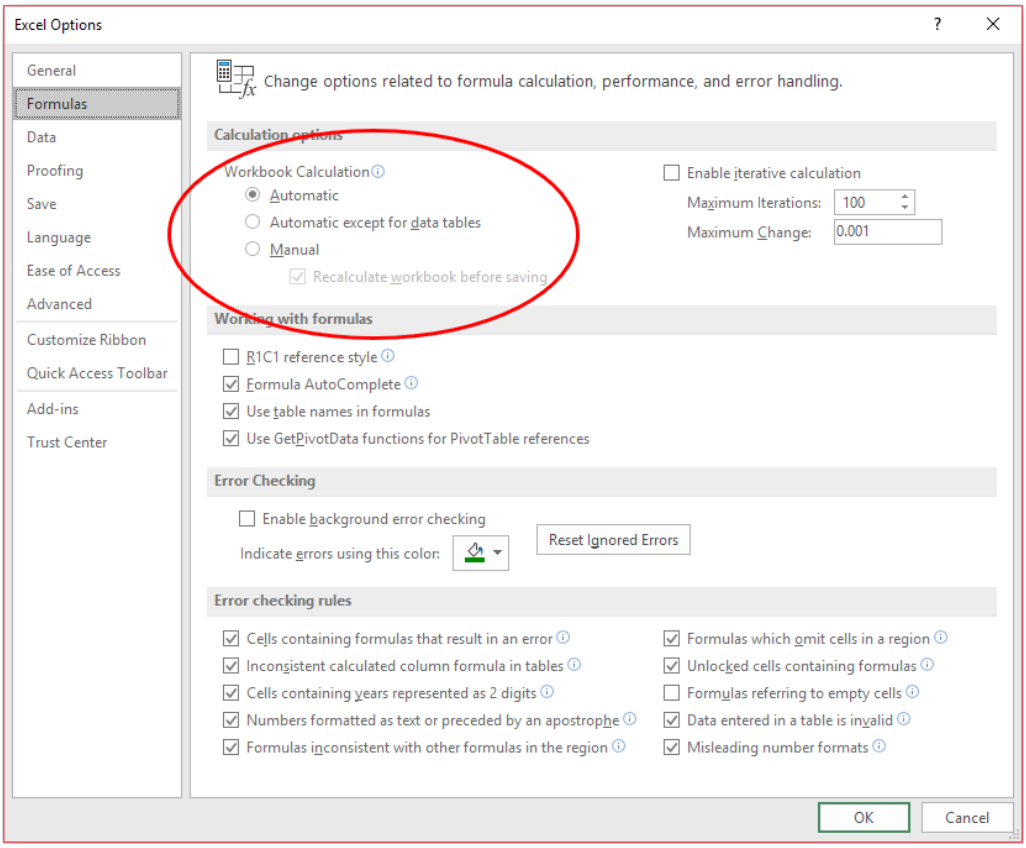
and press **CTRL + SHIFT + ENTER** rather than **ENTER**. This is known as an **array formula** and these cannot be edited, merely deleted in their entirety.

If the table had been across a row instead, ensure that the input values are in the top row, and that the 'headings' are in the first column (that is, transpose the example table, above). Then, you would populate the 'Row input cell:' box instead.

1-D Data Tables do not need to be simply two columns or two rows. It is entirely possible to display the effects on more than one output at the same time provided you wish to use the same inputs throughout the sensitivity analysis as follows:

	A	B	C	D	E	F	G	H	I	J	K	L
26												
27		Data Table										
28												
29					Discount Rate	NPV	Year 0	Year 1	Year 2	Year 3	Year 4	Year 5
30					1.0%	**17,621**	(27,000)	5,941	7,842	12,618	14,415	3,806
31					2.0%	**16,302**	(27,000)	5,882	7,689	12,250	13,858	3,623
32					3.0%	**15,041**	(27,000)	5,825	7,541	11,897	13,327	3,450
33					4.0%	**13,832**	(27,000)	5,769	7,396	11,557	12,822	3,288
34					5.0%	**12,675**	(27,000)	5,714	7,256	11,230	12,341	3,134
35					6.0%	**11,566**	(27,000)	5,660	7,120	10,915	11,881	2,989
36					7.0%	**10,502**	(27,000)	5,607	6,988	10,612	11,443	2,852
37					8.0%	**9,482**	(27,000)	5,556	6,859	10,320	11,025	2,722
38					9.0%	**8,503**	(27,000)	5,505	6,733	10,038	10,626	2,600
39					10.0%	**7,562**	(27,000)	5,455	6,612	9,767	10,245	2,484
40					11.0%	**6,659**	(27,000)	5,405	6,493	9,505	9,881	2,374
41					12.0%	**5,790**	(27,000)	5,357	6,378	9,253	9,533	2,270
42												

Sometimes, you may find all of the numbers in your Data Table are identical. If this happens, you need to check your calculation settings. To do this, go to Excel Options (**File -> Options or Alt + T + O**) and then select 'Formulas'. In the 'Calculation options' section, please ensure the 'Workbook Calculation' is set to 'Automatic':



Any other setting will not calculate Data Tables correctly. The reason for this is Data Tables can consume a significant amount of memory and slow down workbook calculations – hence the options to disable them.

2-D Data Tables

These Data Tables are similar in idea: they simply allow for two inputs to be varied at the same time. Let's extend the 1-D example as follows:

2-D Data Table Example

2-D Data Table Example

NPV Assumptions

Discount Rate	5.0%

Relevant Cashflows

No. of Periods	5

	0	1	2	3	4	5
Cashflow	(27,000)	6,000	8,000	13,000	15,000	4,000

Assume cash flows occur at the end of the period.

Net Present Value (NPV)

	0	1	2	3	4	5
Cashflow	(27,000)	6,000	8,000	13,000	15,000	4,000
Discount Factor	1.000	0.952	0.907	0.864	0.823	0.784
PV of Cashflow	(27,000)	5,714	7,256	11,230	12,341	3,134
NPV	12,675					

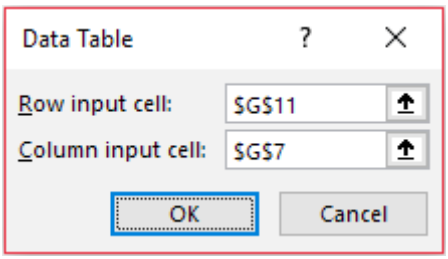
Data Table

	Number of Periods					
Discount Rate	0	1	2	3	4	5
1.0%	(27,000)	(21,059)	(13,217)	(599)	13,815	17,621
2.0%	(27,000)	(21,118)	(13,428)	(1,178)	12,680	16,302
3.0%	(27,000)	(21,175)	(13,634)	(1,737)	11,590	15,041
4.0%	(27,000)	(21,231)	(13,834)	(2,277)	10,545	13,832
5.0%	(27,000)	(21,286)	(14,029)	(2,800)	9,541	12,675
6.0%	(27,000)	(21,340)	(14,220)	(3,305)	8,577	11,566
7.0%	(27,000)	(21,393)	(14,405)	(3,793)	7,650	10,502
8.0%	(27,000)	(21,444)	(14,586)	(4,266)	6,760	9,482
9.0%	(27,000)	(21,495)	(14,762)	(4,724)	5,903	8,503
10.0%	(27,000)	(21,545)	(14,934)	(5,167)	5,078	7,562
11.0%	(27,000)	(21,595)	(15,102)	(5,596)	4,285	6,659
12.0%	(27,000)	(21,643)	(15,265)	(6,012)	3,521	5,790

This example is similar, but only calculates the NPV for a certain number of periods – specified in cell **G11**. Our 2-D Data Table (which is cells **F34:L46**, not **F33:L46**) can answer the question, "What is the NPV of our project over **x** periods with a discount rate of **y**%?".

If anything, a 2-D Data Table is simpler than its 1-D counterpart since there is little confusion over row and column input cells. Again, the output needs to be in the table, this time it must be in the top left hand corner of the array. In our example, it is disguised as "Discount Rate" using similar number formatting to that described earlier.

The inputs required now form the remainder of the top row and the first column of the Data Table. With cells **F34:L46** highlighted, the Data Table dialog box is opened as before:

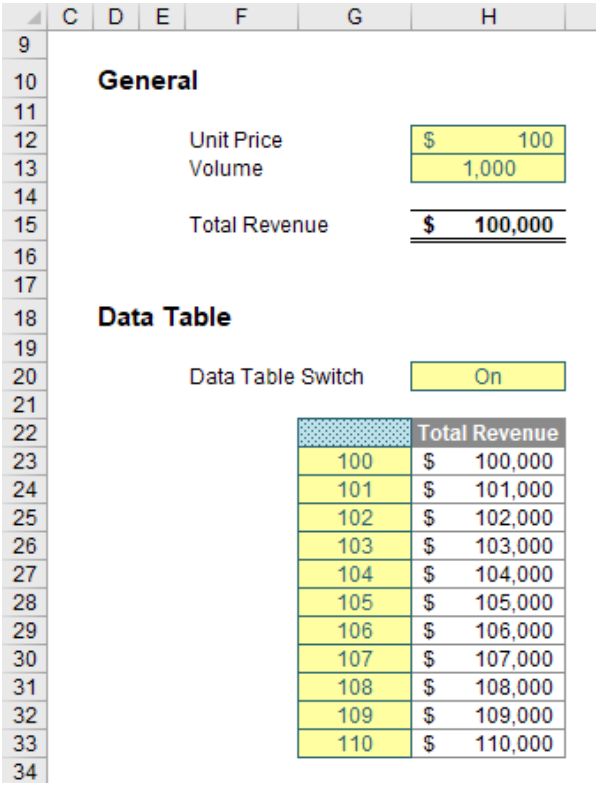


Since the top row are the inputs for the Number of Periods, the 'Row input cell:' should reference **$G$11**, whilst the discount rate inputs ('Column input cell:') should link to **$G$7** once more.

Once 'OK' is clicked, the Data Table will populate as required – simple!

Data Table Inputs Should Be Hardcoded

Don't use formulas for inputs in either the first row or column of a Data Table. Let me explain why, by considering the following example:



General

Unit Price	$ 100
Volume	1,000
Total Revenue	**$ 100,000**

Data Table

Data Table Switch	On

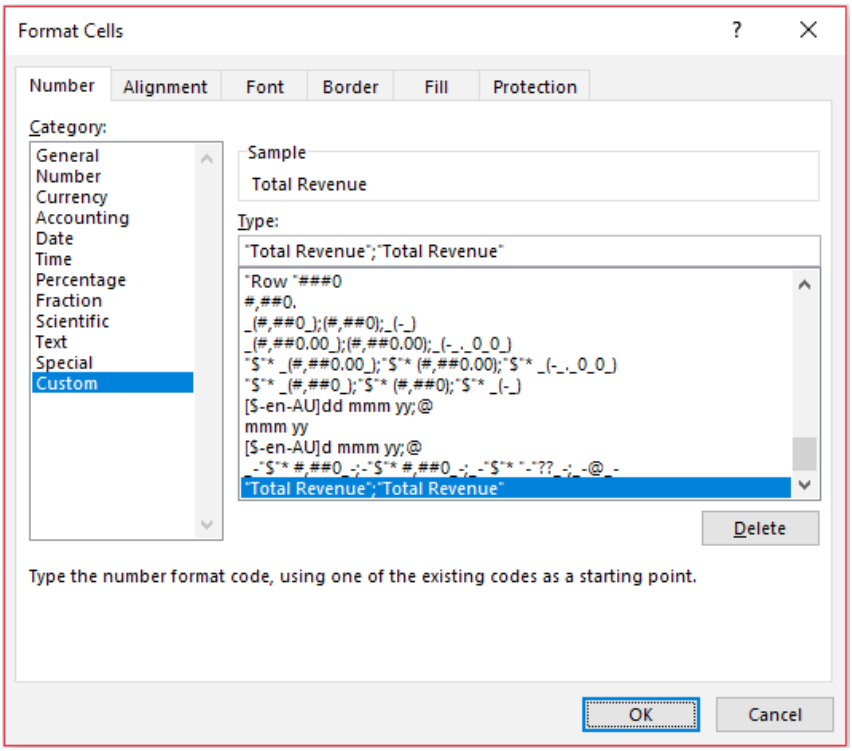
	Total Revenue
100	$ 100,000
101	$ 101,000
102	$ 102,000
103	$ 103,000
104	$ 104,000
105	$ 105,000
106	$ 106,000
107	$ 107,000
108	$ 108,000
109	$ 109,000
110	$ 110,000

To be fair, this spreadsheet is arguably too simple to create a Data Table output, but I am using it to highlight the dangers of using formulas for inputs. In this example, all cells in yellow are inputs. The calculation in cell **H15** is very simple: **=H12*H13**. But that's not the point here.

Cell **H20** contains "On", which is used for the formula in cell **H22**:

=IF(H20="On",H15,)

that is, the formula refers to the Total Revenue in cell **H15** if the value in cell **H20** is "On". The reason this cell appears to be a heading that says "Total Revenue" is we have used the number formatting (**Ctrl + 1**) trick again:

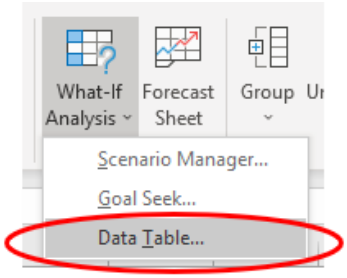


The 'Number' formatting is 'Custom' and has the key

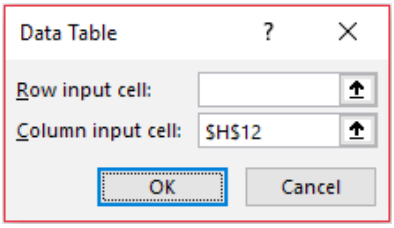
"Total Revenue";"Total Revenue"

This means that if the value is a non-negative number (that is, a zero or a positive number), the value will appear as "Total Revenue" (the text before the delimiting semi-colon), and if it is negative it will also appear as "Total Revenue" (the text after the semi-colon).

After the required input values (100 to 110 inclusive, as displayed) have been hard coded into cells **G23:G33**, the range **G22:H33** has been selected, and then a Data Table has been created by selecting 'Data Table…' from the 'What-If Analysis' drop-down in the 'Forecast' group of the 'Data' tab of the Ribbon:

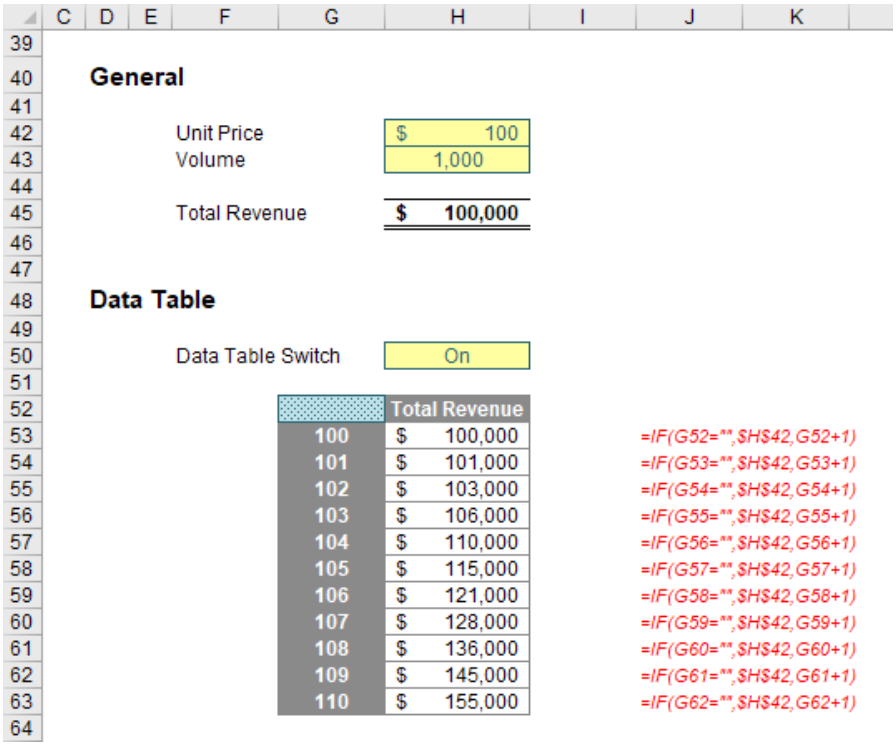


Since the inputs go down a column and the input cell is in cell **H12**, the resulting 'Data Table' dialog has been populated thus:



Assuming workbook calculations are set to 'Automatic (**Alt + T + O**), that's all you have to do – simple!

So, what's the problem? Consider this revised example:



General

Unit Price	$ 100
Volume	1,000
Total Revenue	**$ 100,000**

Data Table

Data Table Switch	On

	Total Revenue	
100	$ 100,000	=IF(G52="",$H$42,G52+1)
101	$ 101,000	=IF(G53="",$H$42,G53+1)
102	$ 103,000	=IF(G54="",$H$42,G54+1)
103	$ 106,000	=IF(G55="",$H$42,G55+1)
104	$ 110,000	=IF(G56="",$H$42,G56+1)
105	$ 115,000	=IF(G57="",$H$42,G57+1)
106	$ 121,000	=IF(G58="",$H$42,G58+1)
107	$ 128,000	=IF(G59="",$H$42,G59+1)
108	$ 136,000	=IF(G60="",$H$42,G60+1)
109	$ 145,000	=IF(G61="",$H$42,G61+1)
110	$ 155,000	=IF(G62="",$H$42,G62+1)

Here, the columnar inputs (cells **G53:G63**) have been replaced by a formula:

=IF(G52="",$H$42,G52+1)

This seems to be fairly innocuous and theoretically, should make the worksheet more efficient as inputs do not need to be typed in twice. However, look closer. The values in cells **H55:H63** are *wrong*. This is a common trap. It's dangerous using formulaic inputs in a Data Table.

So what went wrong?

A 1-dimensional columnar Data Table works procedurally as follows:

1. Take the first input and put it in the input cell (so here, the value in cell **G53** – 100 presently – would be copied as a value into cell **H42**)
2. This would cause the values in the formulaic inputs to update (so cells **G53:G63** would be updated to [still] display 100, 101, …, 109, 110)
3. The result (cell **H45**, $100,000) would be recorded in the first row of outputs (cell **H53**)
4. The second input – currently 101 (cell **G54**) – would then be pasted as a value into the input cell (cell **H42**)
5. This would cause the values in the formulaic inputs to update (so cells **G53:G63** would be updated to now display 101, 102, …, 110, 111 – these values have *changed*)
6. The result (cell **H45**, $101,000) would be recorded in the second row of outputs (cell **H54**) (this is why this output remains correct)
7. The third input – now revised to 103, not 102 (cell **G55**) – would then be pasted as a value into the input cell (cell **H42**)
8. This would cause the values in the formulaic inputs to update (so cells **G53:G63** would be updated to now display 103, 104, …, 112, 113 – these values have *changed*)
9. The result (cell **H45**, $103,000, being $103 multiplied by 1,000) would be recorded in the third row of outputs (cell **H55**) (this is why this output is incorrect)
10. The fourth input – now revised to 106, not 103 (cell **G56**) – would then be pasted as a value into the input cell (cell **H42**)
11. This would cause the values in the formulaic inputs to update (so cells **G53:G63** would be updated to now display 106, 107, …, 115, 116 – these values have *changed*)
12. The result (cell **H45**, $106,000, being $106 multiplied by 1,000) would be recorded in the fourth row of outputs (cell **H56**) (this is why this output is also incorrect)
13. And so on…
14. When all outputs have been determined, the Data Table input values (cells **G53:G63**) are then reset to the original values (100 to 110 inclusive).

Explained like this, it's easy to see the problem. If cell **G53** had been left as a hard-coded value, or linked to an independent cell elsewhere, this would not have happened. However, people don't get this, and the internet is littered with end users moaning that their Data Tables are wrong and Excel makes errors. It doesn't; people do. Be careful; use inputs!

Visual Basics

We thought we'd run an elementary series going through the rudiments of Visual Basic for Applications (VBA) as a springboard for newer users. This month, we look at running a macro.

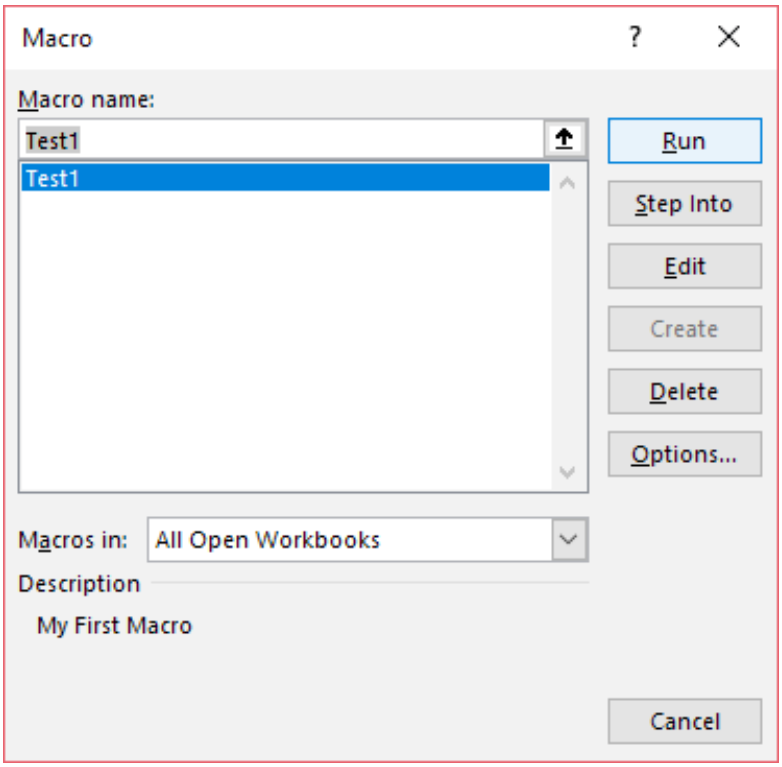
If you have written a macro, chances are you'll want to run it. They don't end to win awards for artistic beauty or impact on world peace. There are a few ways to run a macro:

1. From the 'Macro' dialog box
2. Running it from the VBA Editor
3. Using a predefined keyboard shortcut
4. Anchoring the macro to a form control
5. Setting it to automatically run on a specific event.

This month, we'll take a look at the first four ways of doing this.

1. From the 'Macro' dialog box

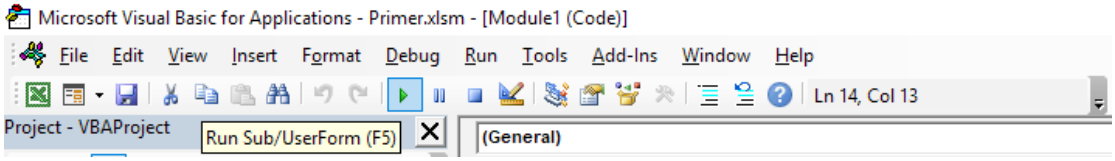
Select the intended macro from the list in the dialog (**ALT + L + PM**) and hit the 'Run' button:



It's not rocket science.

2. Running it from the VBA Editor

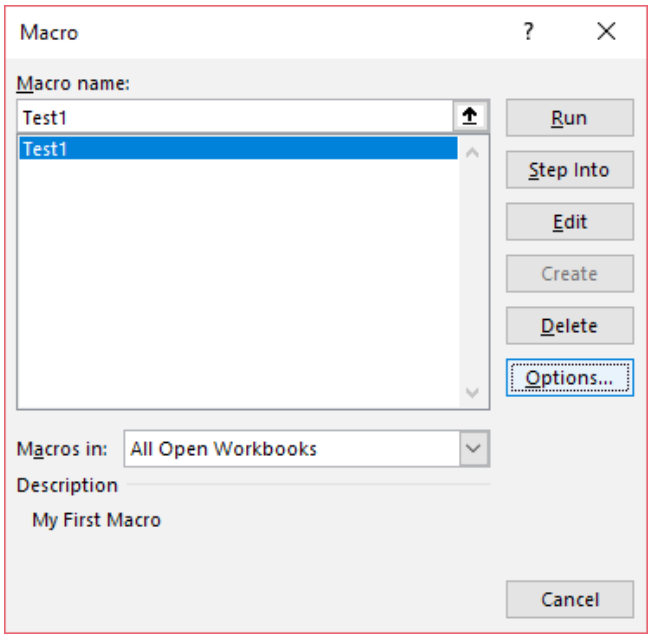
In the VBA Editor (**ALT + F11**), there is a tool bar at the top:



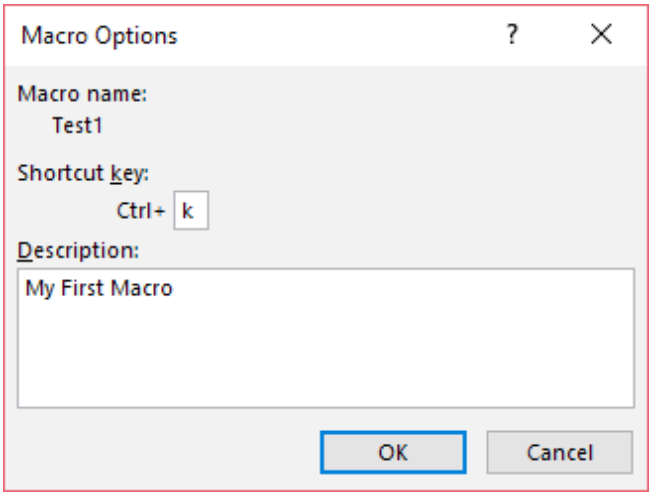
The 'Run Sub / UserForm (Shortcut: **F5**)' button looks similar to the 'Play' button on most electronic devices. Ensure the cursor is in the Code Window *within the procedure* to be run. If the cursor is not within any procedure then the 'Macro' dialog box will pop up to prompt to select one to run.

3. Using a predefined shortcut

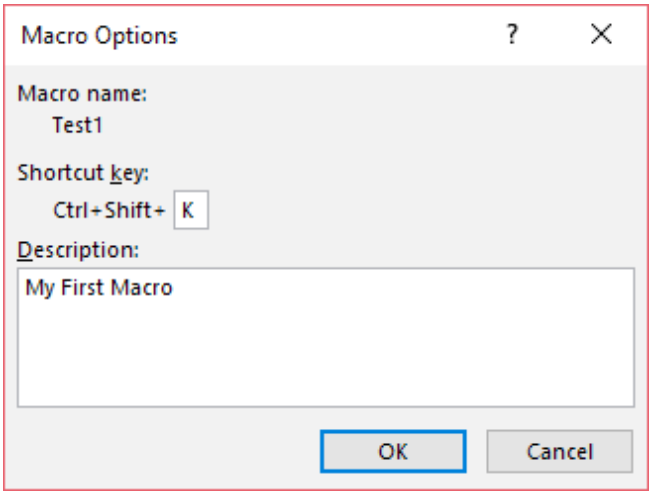
Initially when recording the macro, the option to create a shortcut key is presented. This can be set after the fact by clicking on the 'Options…' button on the 'Macro' dialog box:



The 'Macro Options' dialog box will appear:



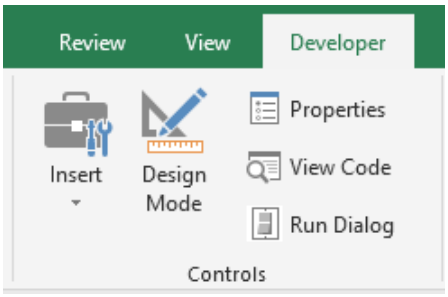
Any alphanumeric key can be used to create shortcut key. **SHIFT** can also be combined as well, by holding shift in conjunction with the key.



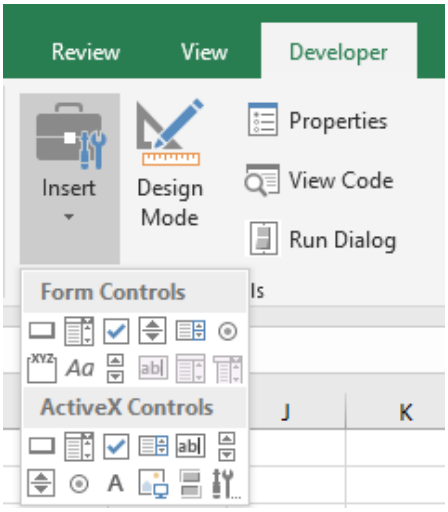
However, macro shortcut keys take precedence over Excel. This means that if an action is assigned to a keyboard shortcut that is already assigned to Excel, this keyboard shortcut replaces the Access key assignment. For example, **CTRL + C** is the keyboard shortcut for the 'Copy' command; if we assign this keyboard shortcut to a macro, Excel will run the macro instead of the 'Copy' command.

4. Anchoring the macro to a form control

In the 'Developer' tab of the Ribbon, there is the 'Controls' category:



Clicking on 'Insert', a drop down will appear of different things that can be included to create UserForms.

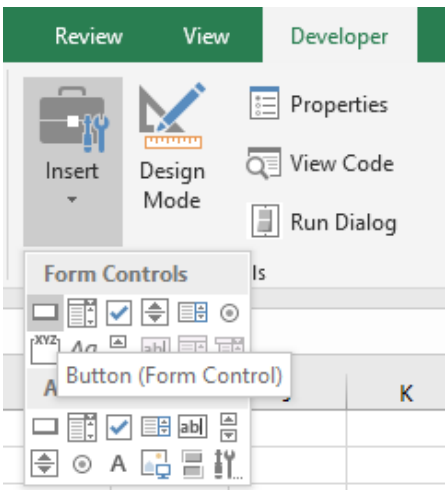


There are two types of controls: Form Controls and ActiveX controls:

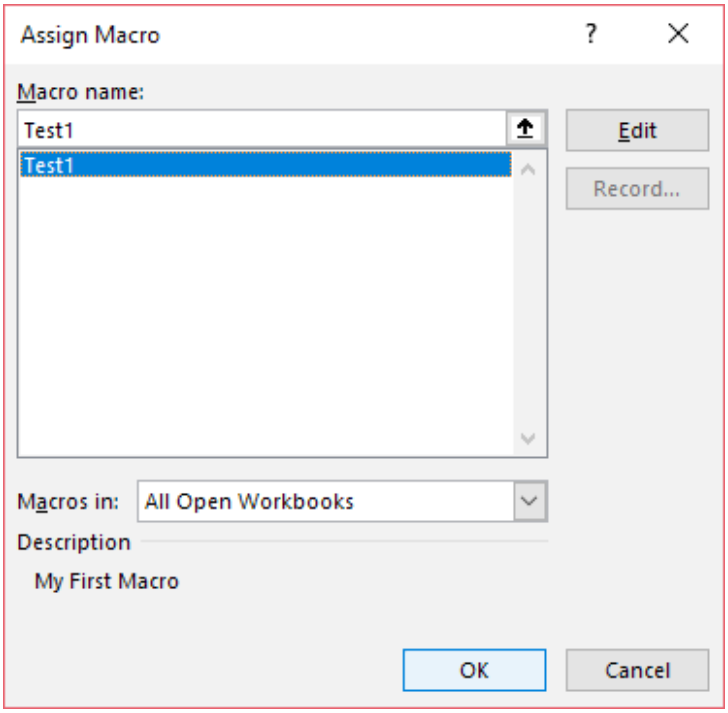
- Form controls are built in to Excel whereas ActiveX controls are loaded separately
- ActiveX controls allow for more flexible design and should be used when the job just can't be done with a basic Forms control.

However, many users' computers won't trust ActiveX by default, therefore ActiveX controls are usually disabled and may be required to be manually added to the Trust Center. One more thing to note is that ActiveX is a Microsoft-based technology and is not supported on the Mac. However, this may change very soon.

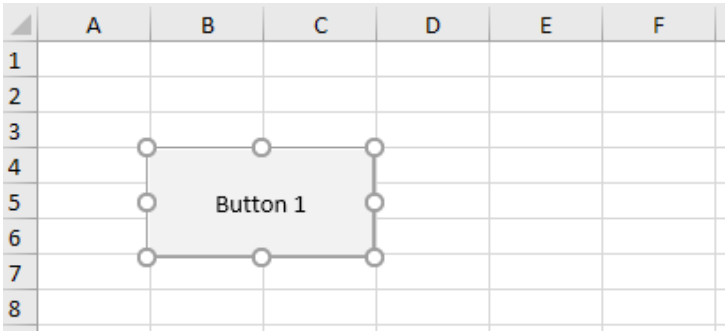
Bearing all this in mind, click on the first 'Form Control' button:



The cursor will turn into a cross and draw a rectangle with like when inserting shapes. An 'Assign Macro' dialog will appear. It will give the option for creating a "Button1_Click", but any previously written macro can be selected.



A button will appear on the worksheet ready for use.



5. Setting it to automatically run on a specific event

Ah, that's a little more sophisticated – and we'll return to that next month…

Power Pivot Principles

A New Year, a new series. We've been running the Power Query / Get & Transform series in our newsletter for some time now, so we thought it might be worth paying some attention to its sister feature, Power Pivot…

Power Pivot is an extension of Excel, it allows Excel to transform large volumes of data into sophisticated and malleable data models, allowing you to perform powerful data analysis. Unfortunately, Power Pivot doesn't work in all versions of Excel. SumProduct had one of the first web pages back in 2013 to provide more detail, but it's interesting to note, six years on, confusion still reigns supreme.

In summary it works like this:

	Versions Supported	Not Supported
Excel 2007 & Earlier	n/a	All
Excel 2010	All versions supported	n/a
Excel 2013	Excel 2013 standalone Office 2013 Professional Plus	Office Home & Student 2013 Office Home & Business 2013 Office Standard 2013 Office Professional 2013 Office RT 2013
Excel 2016	Office Professional 2016 Office 2016 Professional Plus (available via volume licensing only) Excel 2016 standalone	Office Home & Student 2016 Office Home & Business 2016
Excel 2019	Office Professional 2019 Office 2019 Professional Plus (available via volume licensing only) Excel 2019 standalone	Office Home & Student 2019 Office Home & Business 2019
Office 365	All versions supported	n/a
Office Mac / Android	n/a	Office for Mac Office for Android

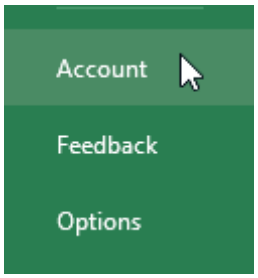
The process of installing Power Pivot differs depending on the version of Excel you use:

- **Excel 2003 and earlier:** No compatibility (what are you still doing with these versions – Microsoft no longer supports these versions and they may now contain potential security issues)
- **Excel 2007:** This version of Excel only provides limited access to Power Pivot. It can be used to open a Power Pivot workbook to make style and formatting changes, but it can't be used to interact with the PivotTable or PivotChart produced from the Power Pivot data (again, why are you using this version of Excel?)
- **Excel 2010:** You can download the COM Add-In here: www.microsoft.com/en-ph/download/details.aspx?id=43348 (note it is not supported "officially" by Microsoft although it is still available; we recommend using a newer version of Excel)
- **Other supported versions:** Open Excel, go to **File -> Options -> Add-Ins -> Manage -> COM Add-Ins -> Go**. Check the box for Microsoft Office PowerPivot for Excel, and then Power Pivot will appear as a tab on the Ribbon.

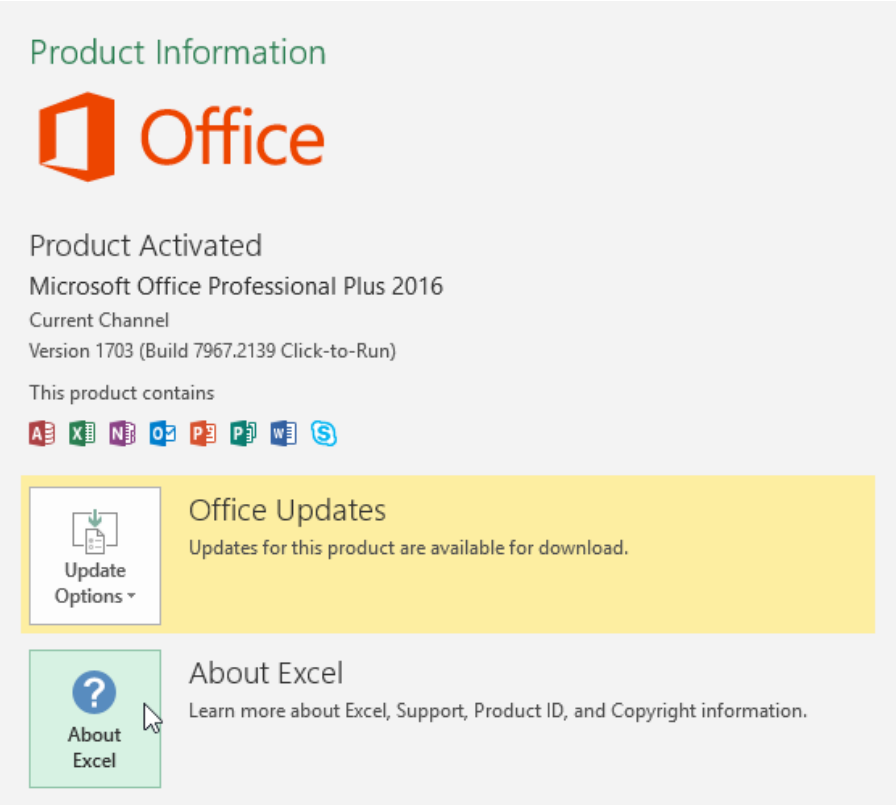
It's also worth noting whether you are using 32-bit or 64-bit Excel as this will have an impact on which version of Power Pivot you will need to download (where applicable, *i.e.* Excel 2010). But it's good to know in any case. Where possible, 64-bit is typically preferable as it allows you to work with much more data. To check this:

- Open Excel
- Go to the 'File' tab on the Ribbon

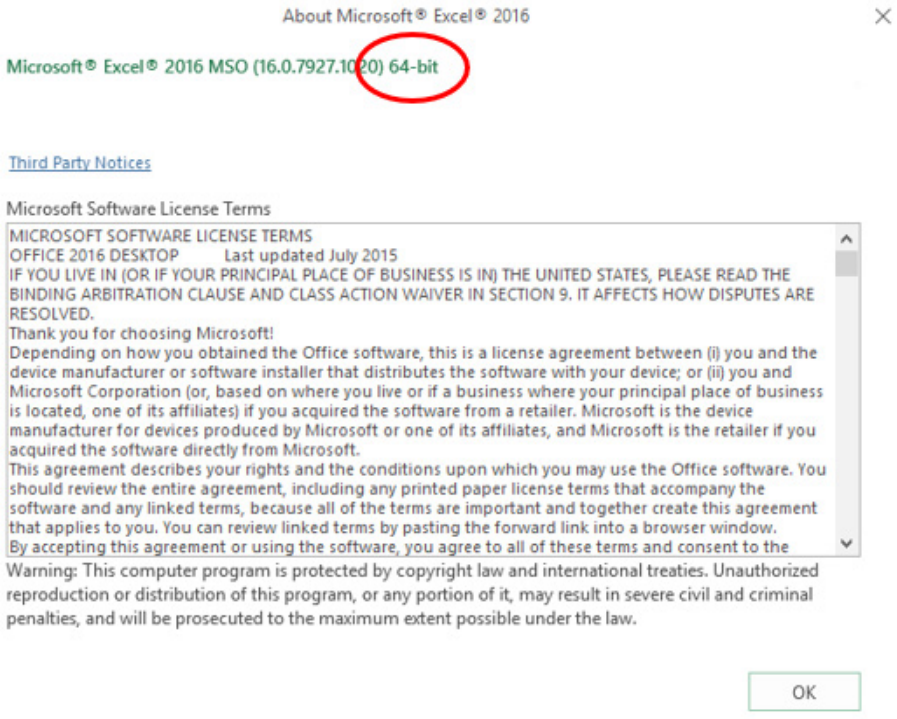
- Select the 'Account' option on the navigation bar (column on the left):



- Then select the 'About Excel' option:



- The version of Excel will be displayed at the top of the pop-up window:

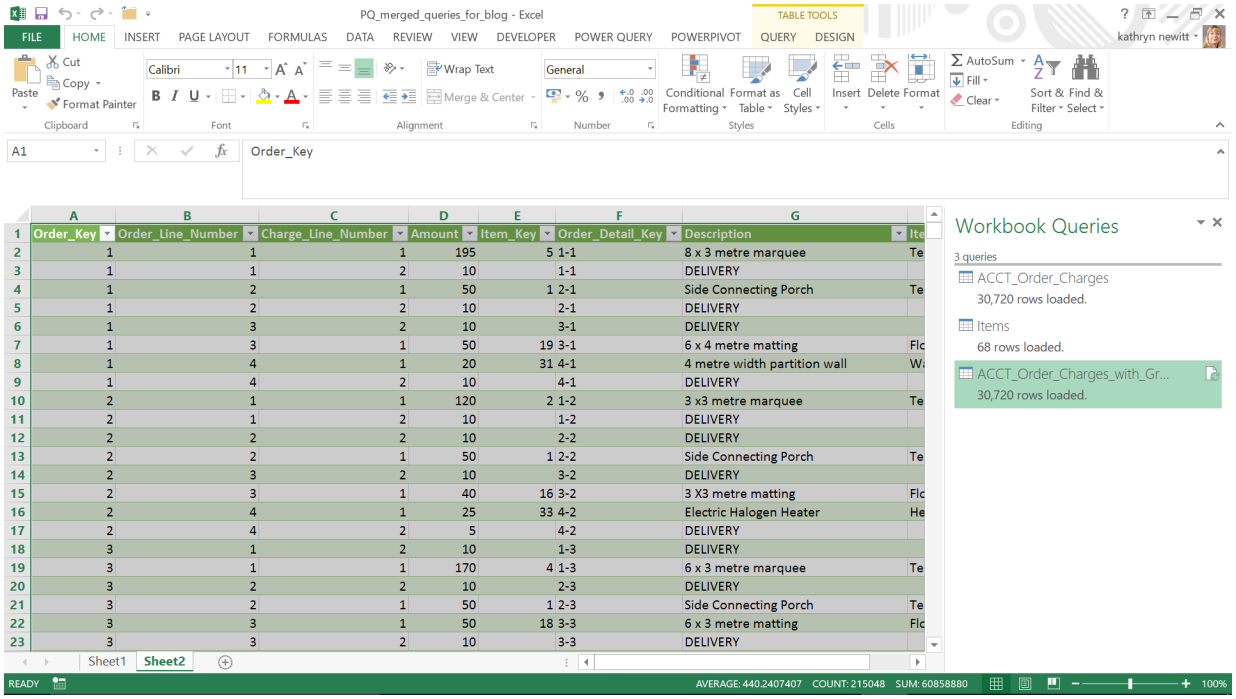


You're now good to go. Stay tuned for our next post on Power Pivot. In the meantime, please remember we have training in Power Pivot which you can find out more about at www.sumproduct.com/courses/power-pivot-power-query-and-power-bi.

Power Query Pointers

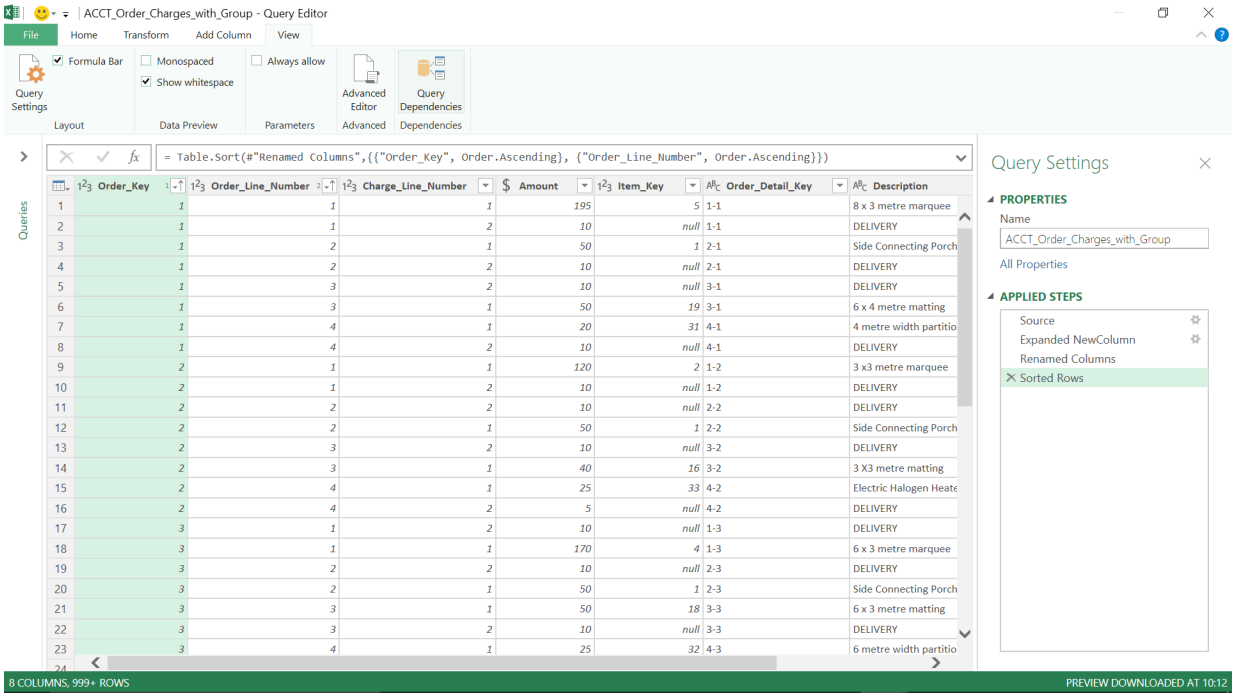
Each month we'll reproduce one of our articles on Power Query (Excel 2010 and 2013) / Get & Transform (Excel 2016) from www.sumproduct.com/blog. If you wish to read more in the meantime, simply check out our Blog section each Wednesday. This month, we look at the Power Query Dependencies Viewer.

For those following the series, past articles have often dipped into the expense accounts where we previously merged some tables from an Access database:

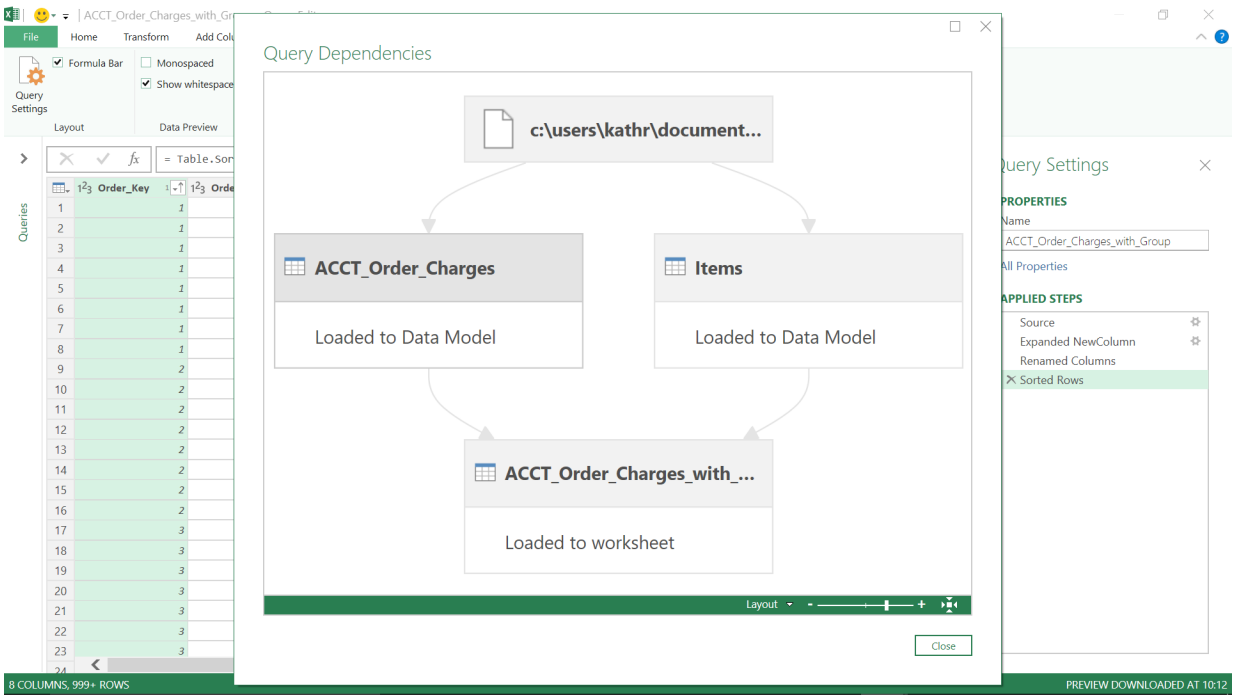


You can double click on '**ACCT_Order_Charges_with_Group**' to edit the query. In fact, the Power Query Dependencies Viewer includes all dependencies in the workbook, so we could have used any query for this.

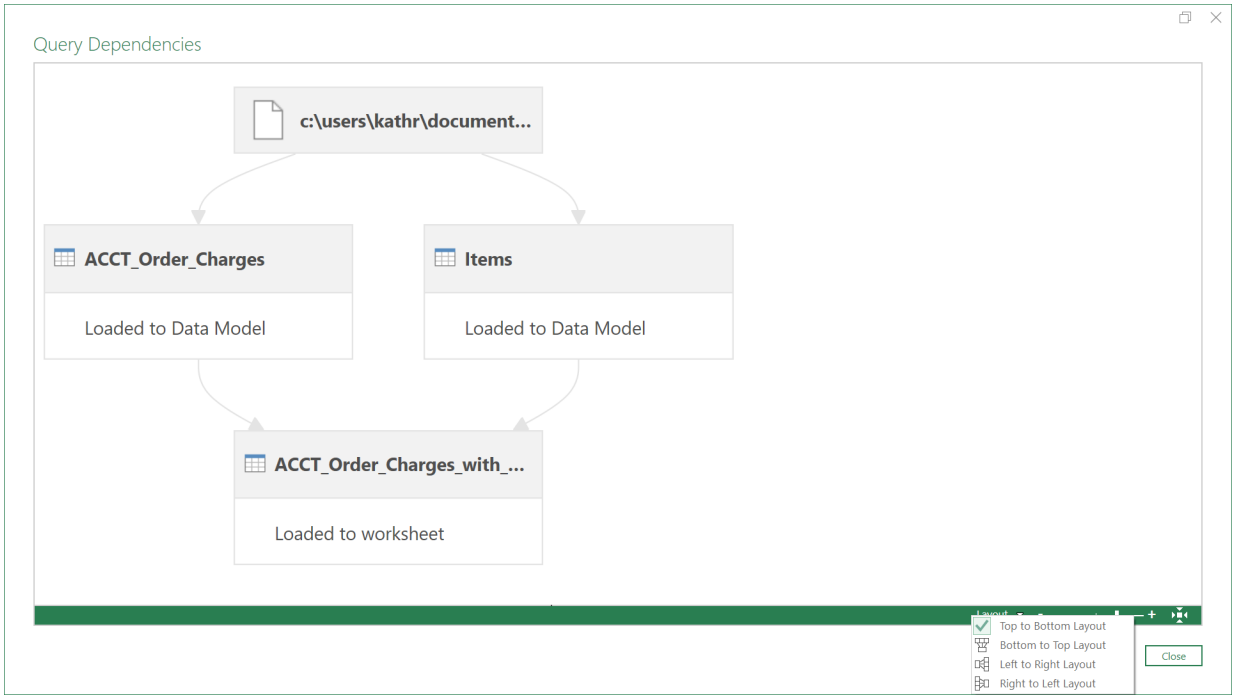
Then, in the Query Editor, let's choose the 'View' tab.



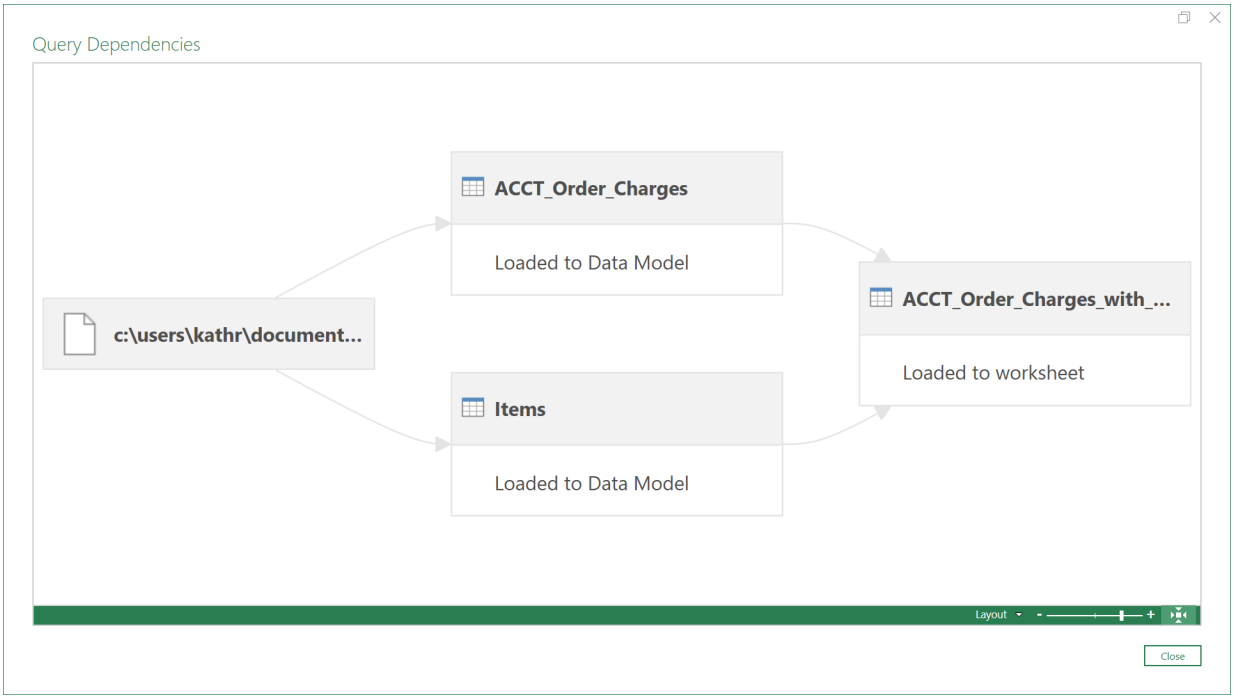
On the right there is a section on 'Dependencies', where we may choose the 'Query Dependencies' button.



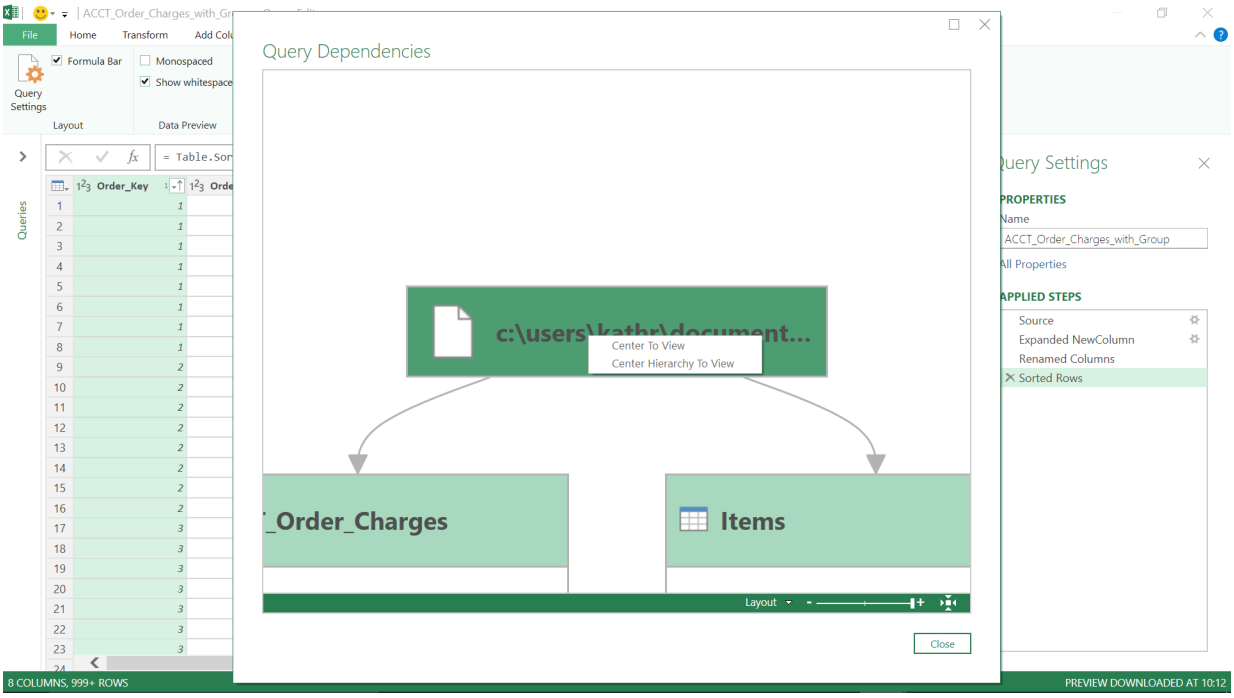
Now admittedly, we haven't chosen the most complicated model to use for this example, because we want to keep things simple. There is the option to expand the window to use the full screen, and at the bottom of the window is a scaling option, which is more useful for large complex models. There is also a 'Layout' dropdown:



The 'Layout' default is 'Top to Bottom' which works well for my model. You can also try 'Left to Right':



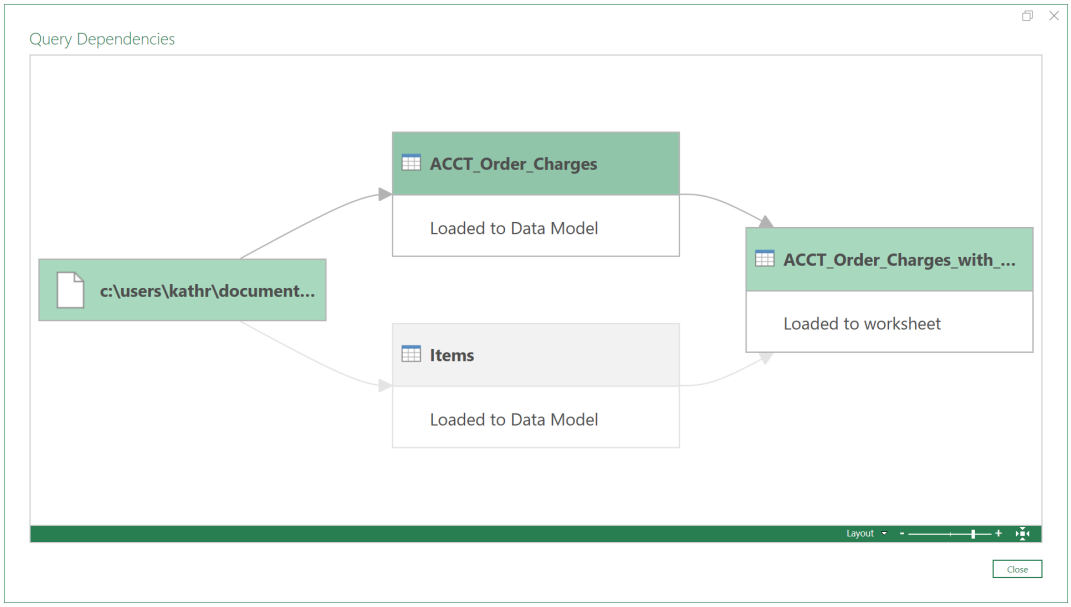
The icon on the right also allows you to 'Fit to Screen', which is useful for complex models, particularly as there is no print option! If I want to concentrate on a particular component, right-clicking on that component allows two more options:



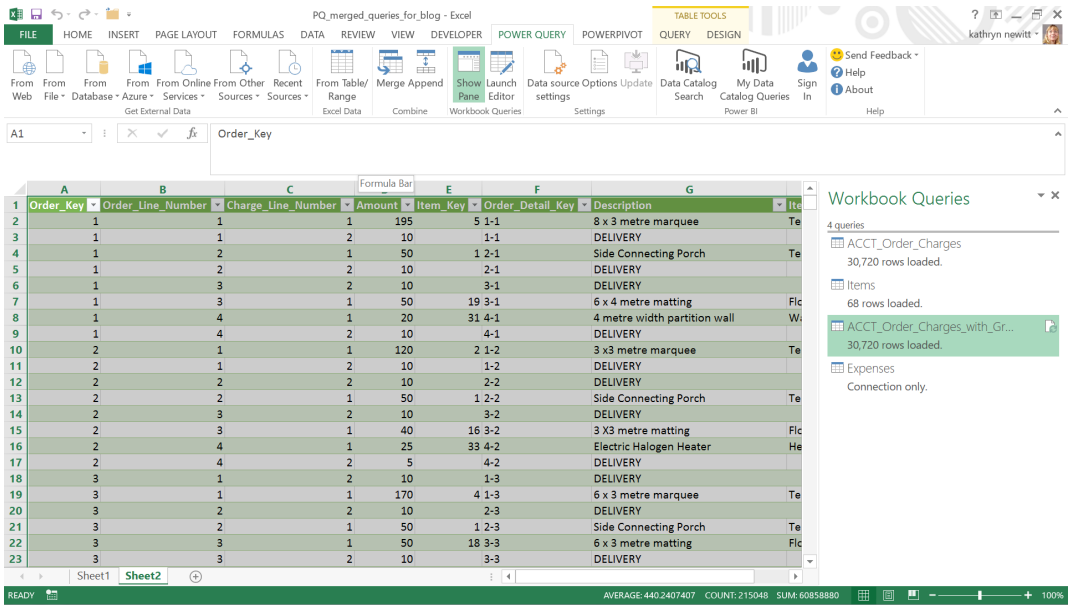
We can make the component the centre of my window ('Center to View'), or make the hierarchy associated with that component central to the view ('Center Hierarchy to View').

Many of these features have been added because we can't do what we would intuitively like to do which is to click and drag parts of the model to display as we wish. We may click and drag, but the whole model moves as one intact unit.

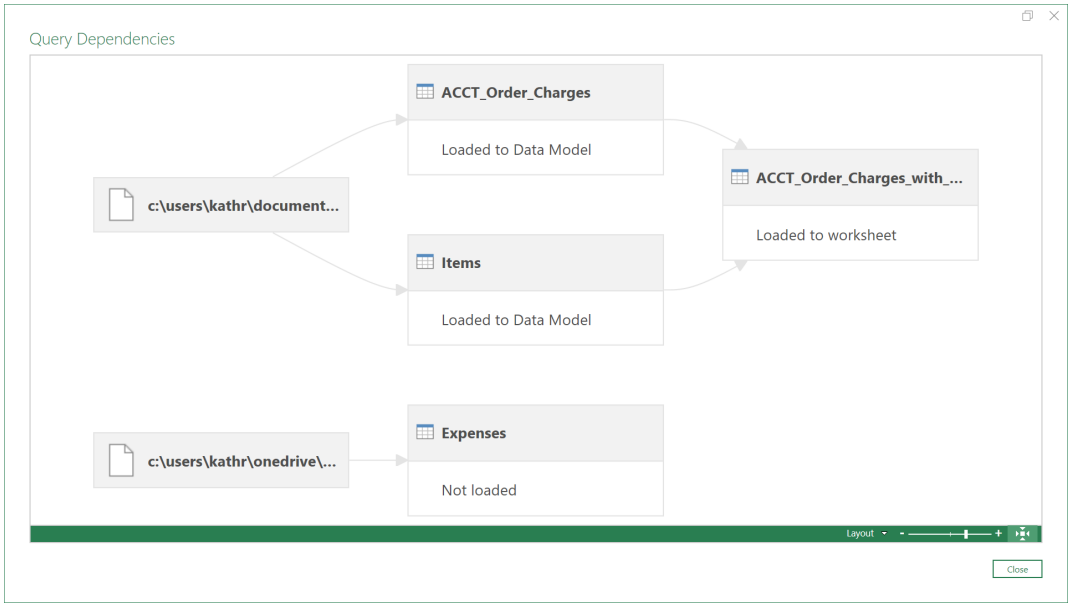
One nice feature, again very useful in more complex models, is that when you click a component, the associated components are highlighted. In the screen below, click on '**ACCT_Order_Charges**':



As there is no direct connection with 'Items', that component is greyed out. To show the different options that can appear for each component, we can add an unrelated query which we will not load to the model.

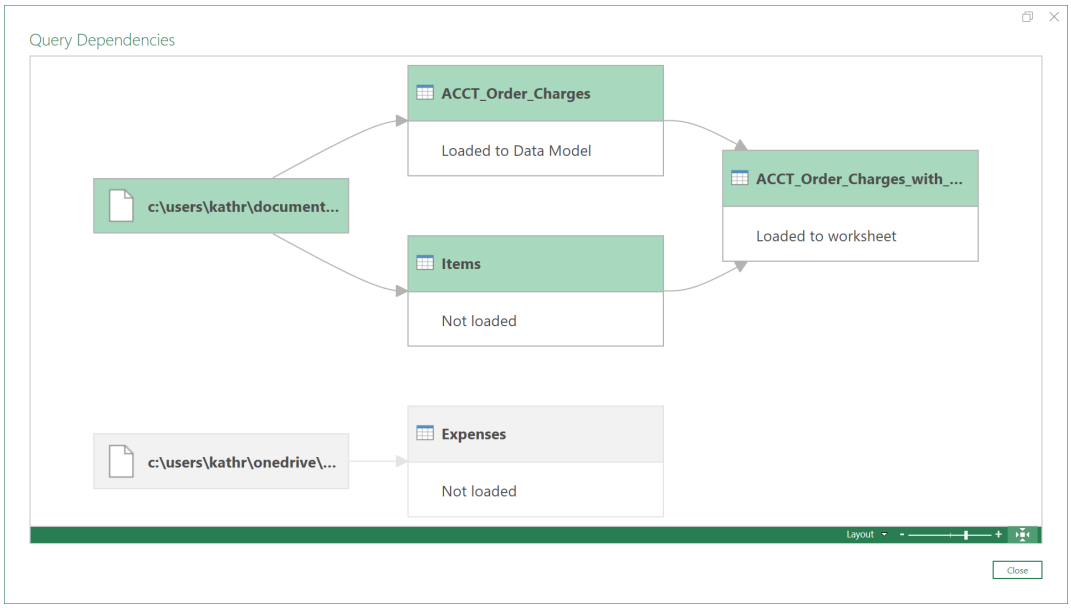


When you view the 'Power Query Dependencies' now, you will see the following:



So, the components are either 'Loaded to Data Model', 'Loaded to worksheet' or 'Not loaded'. 'Not Loaded' means that when you created the query, you opted to make it 'connection only' and not load it into the data model. Note that since we have extracted the queries from different sources, the source paths are shown distinctly on the diagram.

However, 'Not Loaded' can be confusing. Consider the diagram below:



Here, we have gone back to the query pane in the Excel worksheet and set the query 'Items' not to be loaded to the data model. It is still part of the '**ACCT_Order_Charges_with_Groups**' query, so it *is* part of the data loaded to the worksheet.

In summary, the Power Query Dependencies Viewer is useful to get an overview of what is going on in a workbook that uses queries, but we recommend saving before removing any queries that may appear to be 'redundant'!

More next month!

Latest Updates for Power BI Service and Mobile

It's been a while – but they're back! There are some new Previews, rolled out new features, and improved existing functionality across service and mobile:

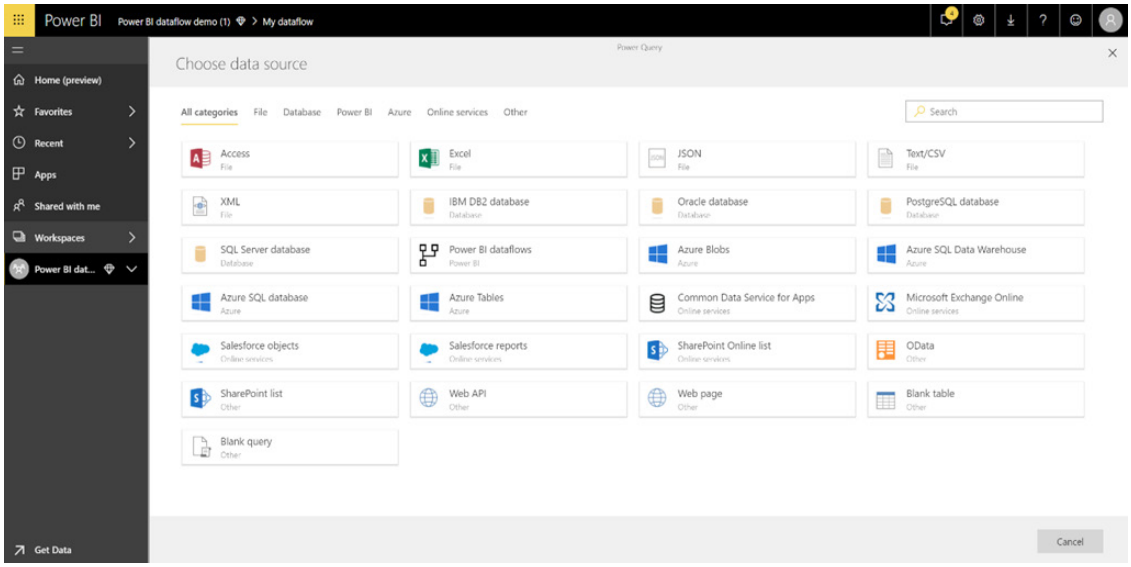
- Power BI data prep with dataflows (Preview)
- Paginated reports in Power BI Premium (Preview)
- Updates to the Premium Capacity Metrics app
- Recommended apps on Power BI Home
- On-premises data gateway updates
- Shared credentials, in-app URLs, and more on Mobile
- Release notes updates
- Personal bookmarks.

Let's go through each new feature in turn.

Power BI data prep with dataflows (Preview)

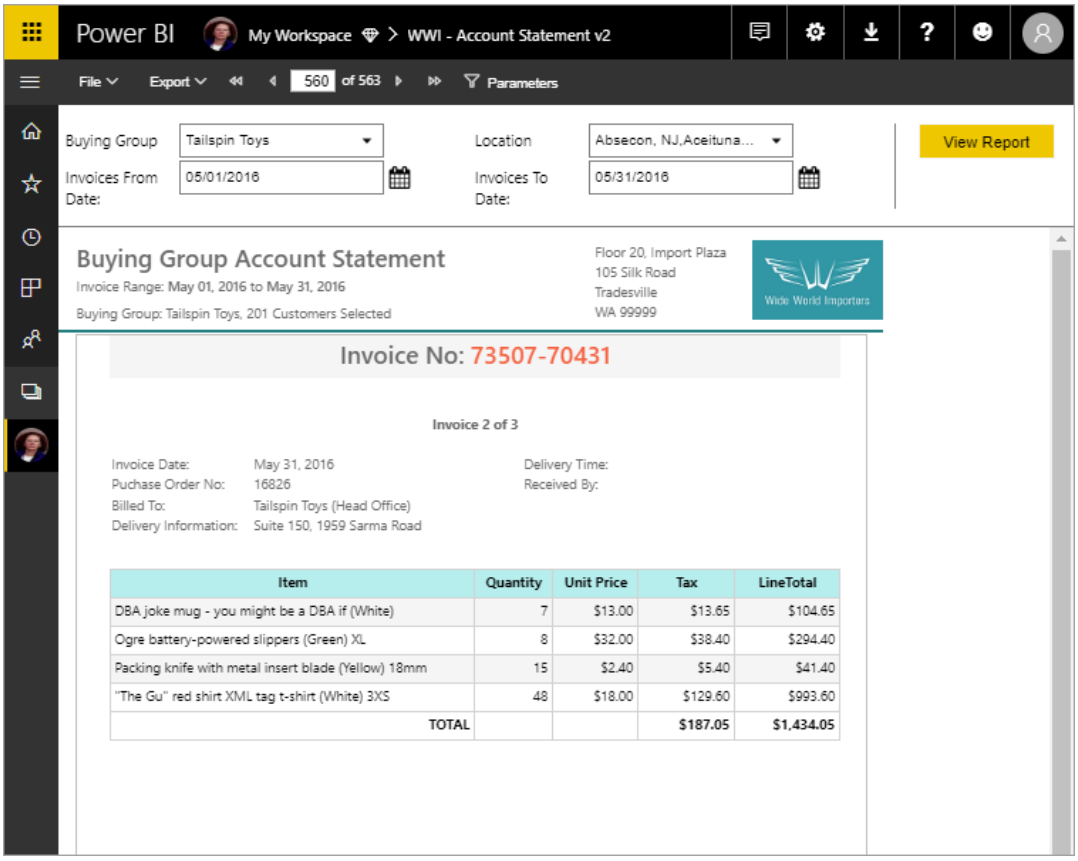
Back in November, Microsoft introduced a public Preview of Power BI dataflows to help organisations unify data from disparate sources and prepare it for modelling. They have taken it a step further: analysts can now create dataflows using familiar self-service tools. Dataflows are used to ingest, transform, integrate, and enrich big data by defining data source connections, Extract Transform and Load (ETL) logic, refresh schedules, and more.

In addition, there's a new model-driven calculation engine that is part of dataflows, which makes the process of data preparation more manageable, deterministic and less cumbersome for data analysts and report creators alike. Dataflows are created and managed in app workspaces by using the Power BI service.



Paginated reports in Power BI Premium (Preview)

There's also a Preview of paginated reports in Power BI Premium. Now, users may view and interact with pixel-perfect paginated reports alongside the existing Power BI interactive reports in the Service and Mobile. You can publish and share paginated reports in your 'My Workspace' or in app workspaces, as long as the workspace is in a Power BI Premium capacity.

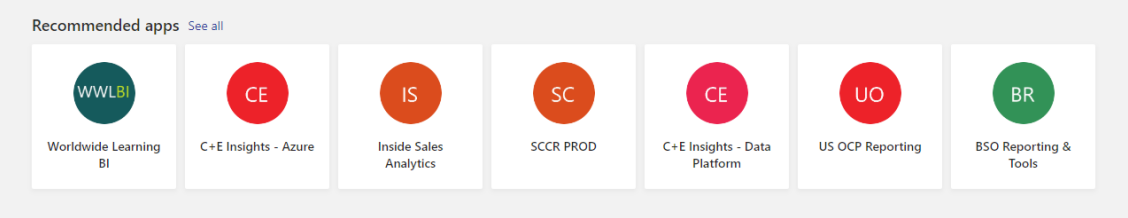


Updates to the Premium Capacity Metrics app

Microsoft has continued to enhance the Power BI Premium Capacity Metrics app to include new metrics for dataset size and count of datasets in memory. At the same time, they have improved the navigation to make it easier for administrators to view these metrics at a workspace level. The latest version (1.10) of the app provides a comprehensive view of workload operations such as dataset and dataflow refreshes, dataset evictions, dataset queries, paginated report data retrieval / execution, and system metrics in the capacity for the past seven days.

Recommended apps on Power BI Home

Back in 2017, Microsoft released AI-powered app recommendations in AppSource to suggest relevant content to end users. Now, this comes to Power BI Home with a new Recommended apps section that surfaces the top apps that might of interest (anyone hear sales plug?).



On-premises data gateway updates

The on-premises data gateway has had an updated mashup engine to ensure that the reports that you publish to the Power BI Service and refresh via the Gateway will go through the same query execution logic / runtime as in the latest Power BI Desktop version. This is a consistency fix.

Shared credentials, in-app URLs, and more on Mobile

There have been a succession of updates to the Power BI mobile apps. The iOS app now supports iOS 12 and watchOS 5. Here is a summary of the latest updates:

- **Shared credentials:** Signing in to Power BI from your mobile app has become easier. With shared credentials, the sign in process has been simplified by using other Office 365 app credentials on the device to authenticate the user against the Power BI service
- **In app URLs:** Links in reports that point to other Power BI artefacts will now open directly inside the app. This will enable authors to build custom navigation flows, for example, linking a report to a dashboard
- **Show & copy data:** Microsoft has added some new report visuals as an option to show the underlying data in table format. Just use the visual "…" in the header, and you'll see the 'Show Data' option. Once you see the table, you can long-tap to select and copy values assuming there is no restriction from InTune policies.

Release notes updates

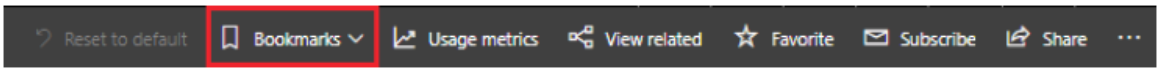
Microsoft uses the Power BI section in the Business Application Release Notes to share details on what's coming in the next three to six months (a "roadmap"). You should check them out. These release notes are updated weekly with details on shipping dates, screenshots and new announcements (although we will always report them here in due course too!).

Personal bookmarks

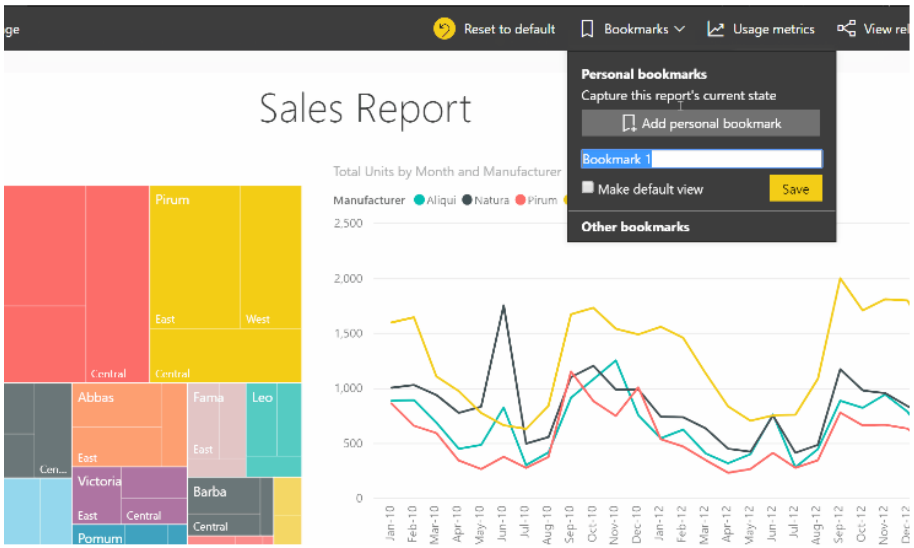
Almost a year ago now, Microsoft announced bookmarking to be Generally Available in Power BI Desktop. You may recall bookmarks are currently used by authors to share saved insights or create intuitive navigation elements within a report. Finally, the end users (the "report consumers" to quote the Microsoft vernacular) will also be able to define their own bookmarks to suit their individual needs.

Personal bookmarks are now Generally Available in the Power BI service. "Report consumers" will now be able to create their own set of bookmarks for each report by capturing various states of a report page (including filters, slicers, and state of visuals), give them friendly names, and later return to each state with just one click. Further, they will be able to make any bookmark that they create the default view, so they may land on their customised view of the report every time they open it.

To see personal bookmarks in action, go to any Power BI report that you have view or edit access to. You will notice a new drop-down in the action bar that says "Bookmarks".



Once you have modified the report to the view that you like, simply expand the Bookmarks drop-down and select 'Add personal bookmark'. By default, the service will suggest a generic name for your bookmark, but you can overwrite this and then select 'Save'.



Once you have a bookmark, you may display it by simply clicking on the bookmark name from the drop-down menu.

When you create a bookmark, the following elements are captured:

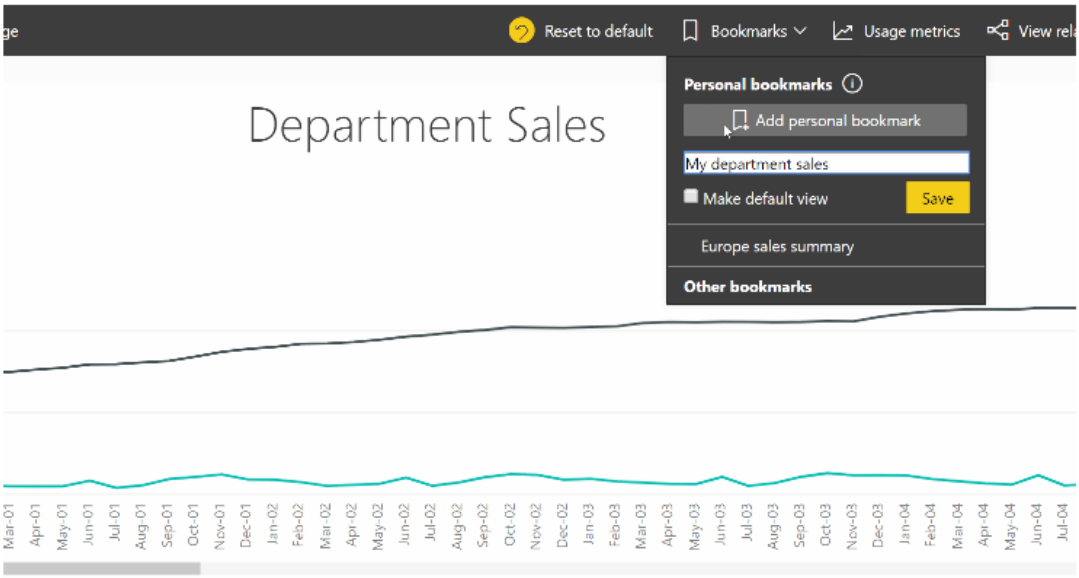
- The current page
- Filters
- Slicers, including slicer type (for example, dropdown or list) and slicer state
- Visual selection state (such as cross-highlight filters)
- Sort order
- Drill location
- Visibility (of an object, using the Selection pane)
- The focus or Spotlight modes of any visible object.

Do bear in mind though that you will only be able to create a maximum of 20 bookmarks per report.

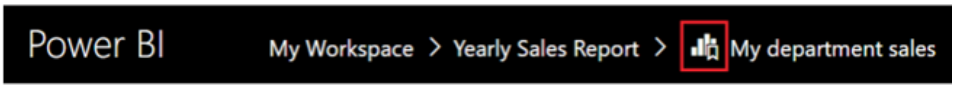
If at any point you want to clear the bookmark and return to the published view of the report, just select the 'Reset to default' button and hit 'Yes' to the dialog.

Whenever you leave and return to a report, the current persistent filters feature (if enabled by author) shows your report with the filters and slicers set as you left them, making it easy for you to pick up where you left off. However, there are many cases where you might not necessarily want that and would rather land in a pre-configured view of the report to begin your analysis. This is where personal bookmarks come in.

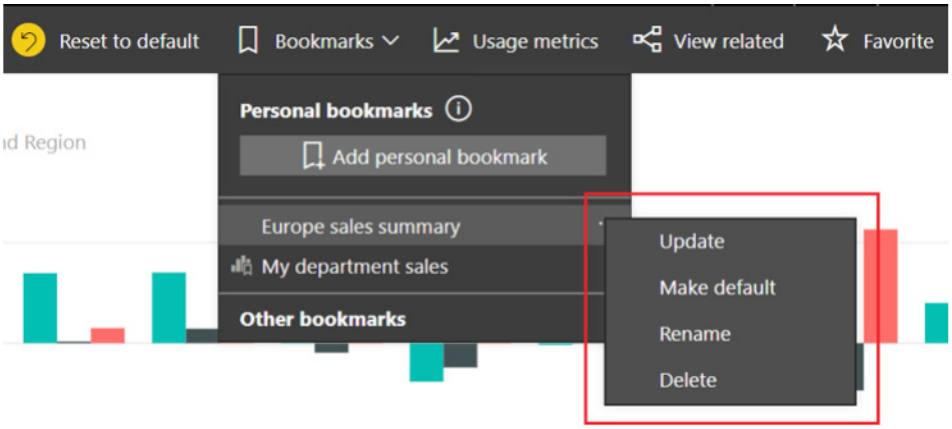
When creating a personal bookmark, you will have an option to set your current view as the default view by selecting the 'Make default view' checkbox. Now, whenever you leave and return to the report, this will override the persistent filter state and land you in the view that you specified.



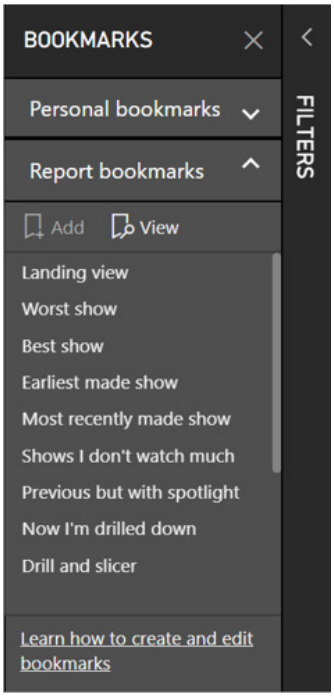
You will notice that a default bookmark has a different icon compared to the other bookmarks that you may have captured in the report.



In addition, you can easily rename, delete, update and choose a default bookmark by selecting the ellipses next to the bookmark's name, then selecting an action from the menu that appears.



If you want to access additional bookmarks that may have been published by the author of the report, simply select 'Other bookmarks' in the 'Bookmarks' drop-down menu to launch the 'Bookmarks' pane. All the bookmarks created by the author will be nested under the 'Report bookmarks' heading:



If you have a collection of bookmarks that you access frequently and want to avoid clicking on the drop-down each time, use the 'Bookmarks' pane to access your bookmarks with one click or just save the URL to your browser bookmark. You can also use the 'View' button in the 'Bookmarks' pane to begin a slide show.

More next month no doubt.

Power BI Report Server Latest Updates

We just managed to sneak this into this month's newsletter. Hot off the press, Microsoft announced in late January its next update of Power BI Report Server. This release features copy and pasting between ***.pbix files***, expand / collapse on matrix row headers, and row-level security support. The full list is as follows:

Report Server

- Row-level security

Reporting

- Dot plot layout support in scatter charts
- Copy value and selection from table and matrix
- Built-in report theme options
- Search in filter cards
- Expand and collapse matrix row headers
- Copy and paste between desktop files
- Smart guides for aligning objects on a page
- Set tab order for objects on a page
- Tooltips for button visuals
- Report accessibility improvements

Modelling

- DAX Editor improvements
- Modelling accessibility improvements
- New DAX functions:
    - Optional **DrilldownFilter** argument for the **RollupAddIsSubtotal** function
    - **NonVisual** function
    - **IsInScope** function

Analytics

- Colour saturation on visuals upgraded to use conditional formatting

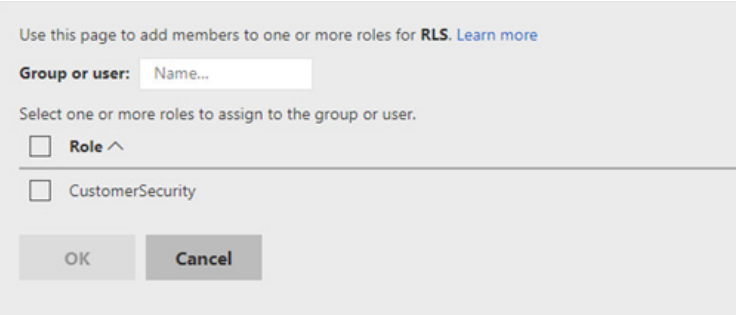
Other

- Updated Power BI Desktop for Report Server icon
- Transport layer security settings
- High contrast support for all panes and report footer
- Improved keyboard shortcuts dialog.

Let's take a look at each in turn.

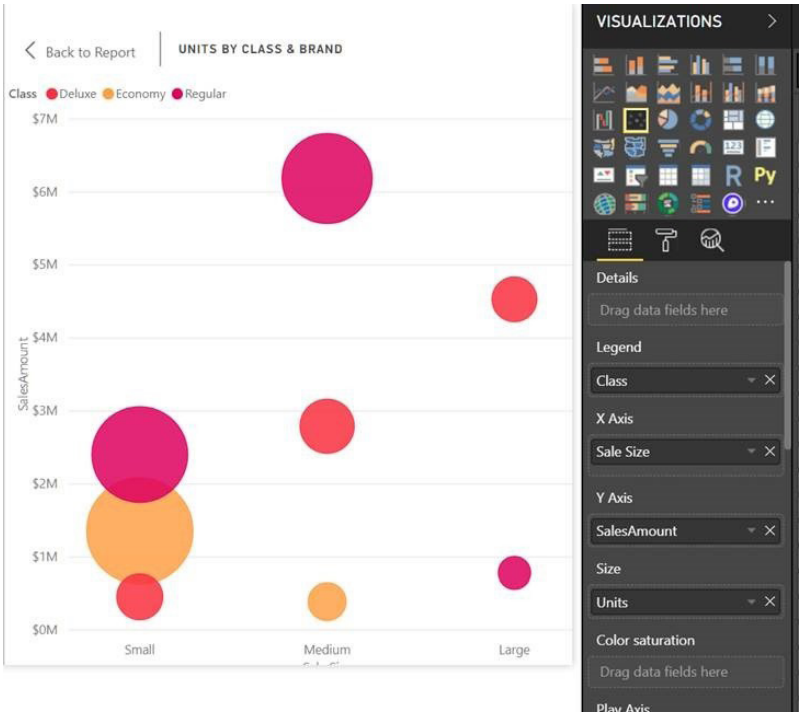
Row-level security

This update includes support for Row-level security in Power BI reports. The feature works in a similar fashion to how it does in the Power BI service. Report authors can set up roles in Power BI Desktop and assign users or groups to those roles in the Power BI Report Server portal once they've published the report. However, unlike the Power BI service, users may not view content in a report until they have been assigned a role in Power BI Report Server.



Dot plot layout support in scatter charts

The scatter chart has been improved in this release. Now, you can use categorical fields on the x-axis of your scatter chart, allowing you to create dot plots. You don't need to do anything special to enable this feature. Just add your categorical field to the x-axis and remove anything you may have in the 'Details' bucket.



This may be used with existing formatting features, and it also work with drilling on the x-axis.

Copy value and selection from table and matrix

There is a growing need to copy data out of Power BI into other applications like Dynamics CRM, Excel and even other Power BI reports. The first feature related to this requirement is the ability to copy a specific value or a selection of data from a table or matrix. You'll be able to find both of these options on the right-click menu.

'Copy value' will add the unformatted value to your clipboard, and from there you can paste it wherever you want. For example, copy value from this cell in my table will add 32130 to my clipboard:

'Copy selection' will add a tabular version of all data currently selected in your table or matrix to the clipboard, including the row and column headers. The data will retain the data formatting that has been applied and subtotals are excluded. This option is very useful if you want to reuse a selection of data in another report in Excel for some quick calculations.

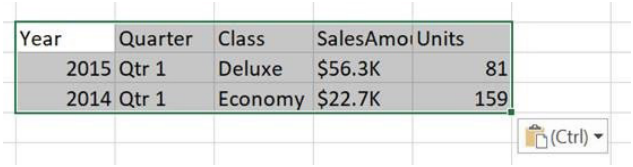
For instance, in the following example, if we have the entire 'Economy' column selected in the matrix and pick 'Copy selection'

we'll get all of this data in a tabular format when pasting into Excel:

	A	B	C	D
1	Year	Quarter	Class	SalesAmount
2	2015	Qtr 4	Economy	$44.4K
3	2015	Qtr 3	Economy	$28.4K
4	2015	Qtr 1	Economy	$26.1K
5	2015	Qtr 2	Economy	$18.6K
6	2014	Qtr 4	Economy	$47.9K
7	2014	Qtr 3	Economy	$20.5K
8	2014	Qtr 1	Economy	$22.7K
9	2014	Qtr 2	Economy	$14.9K
10	2013	Qtr 4	Economy	$12.2K
11	2013	Qtr 3	Economy	$3.1K
12	2013	Qtr 2	Economy	$7.5K
13	2013	Qtr 1	Economy	$4.7K
14	2012	Qtr 3	Economy	$2.1K
15	2012	Qtr 4	Economy	$3.9K
16	2012	Qtr 1	Economy	$1.5K
17	2012	Qtr 2	Economy	$0.4K
18	2011	Qtr 4	Economy	$0.0K

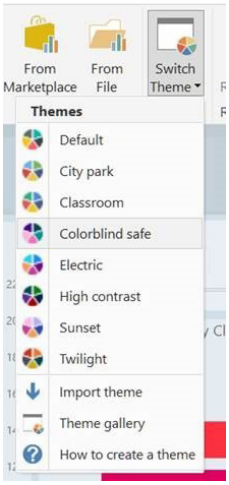
Note that when you have multiple measures in your matrix, they are always selected together, so you'll always get both when copying selection. For example, copying the below selection

will add the following to the clipboard:

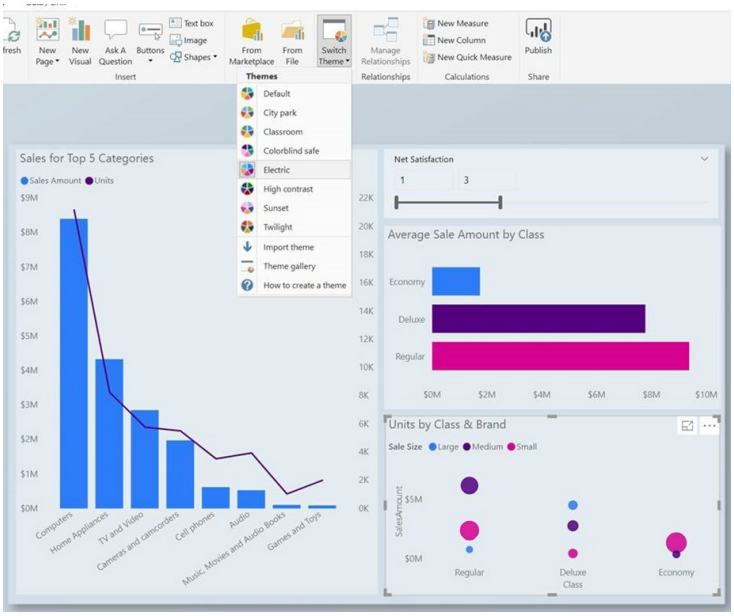


Built-in report theme options

The next update is a themes gallery in the Desktop that lets you pick between several built-in report themes. You'll be able to see these new theme options under the 'Switch Theme' button in the 'Home' Ribbon tab. In addition to the default theme, you can now pick from seven new options:

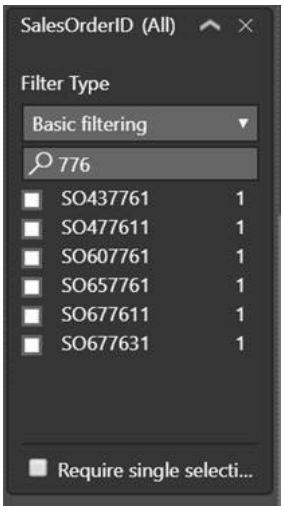


All you need to do is pick the theme of your choice and it will automatically apply its color palette to all your visuals using the default color palette.



Search in filter cards

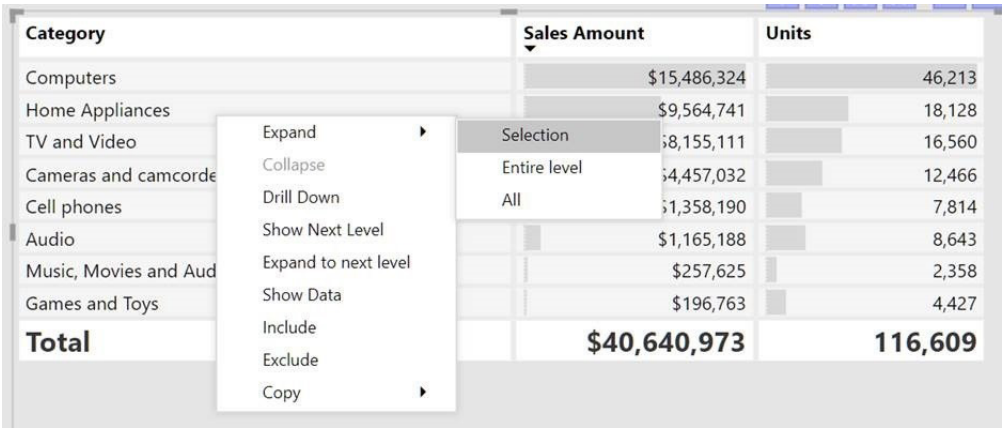
It was back in June 2016 that users became able to search in slicers. It's taken a while, but now with this update, this feature has been added to the basic filter cards as well.



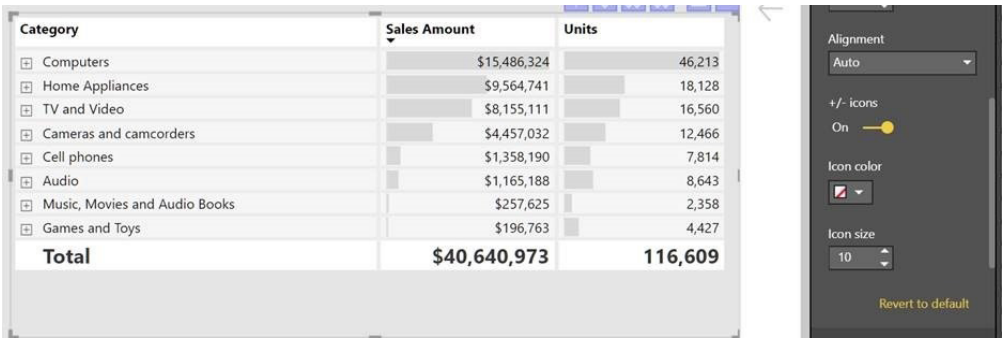
Expand and collapse matrix row headers

This update also provides the ability to expand and collapse individual row headers.

There are two ways you can expand row headers. The first is through the right-click menu. You'll see options to expand the specific row header you clicked on, the entire level or everything down to the very last level of the hierarchy. You have similar options for collapsing row headers as well.



You can also add + / - buttons to the row headers through the 'Formatting' pane under the 'Row headers' card. By default, the icons will match the formatting of the row header, but you can customise the icons' colours and sizes separately if you want.



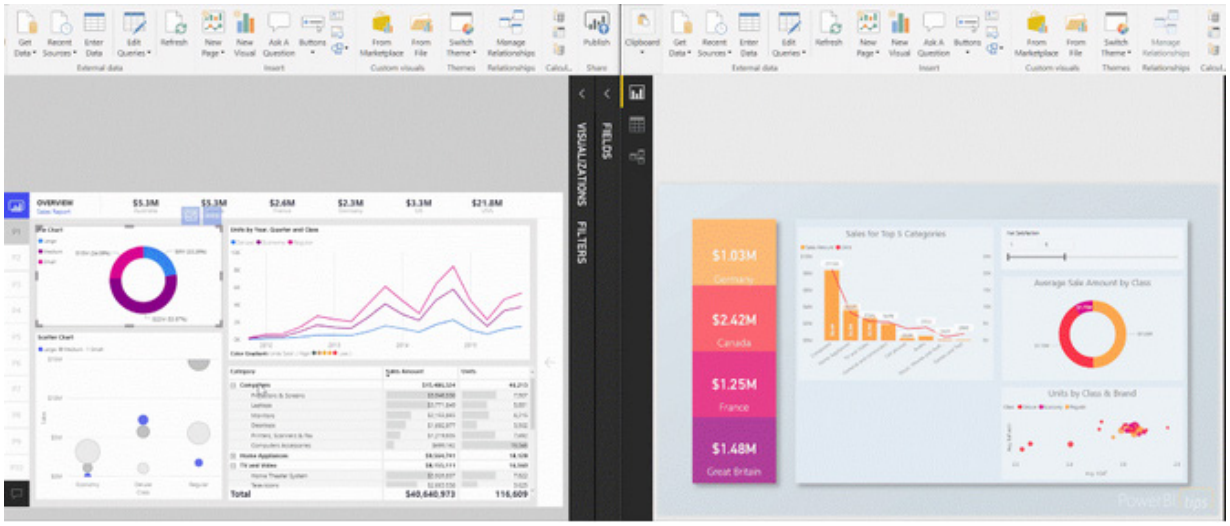
Once the icons are turned on, they work similarly to the icons from PivotTables in Excel.

Category	Sales Amount	Units
⊞ Home Appliances	$9,564,741	18,128
⊟ TV and Video	$8,155,111	16,560
Home Theater System	$3,926,837	7,822
Televisions	$2,663,538	3,625
Car Video	$1,360,357	3,203
VCD & DVD	$204,379	1,910
⊞ Cameras and camcorders	$4,457,032	12,466
⊟ Cell phones	$1,358,190	7,814
Smart phones & PDAs	$745,239	2,635
Touch Screen Phones	$518,090	1,748
Home & Office Phones	$76,157	2,545
Total	**$40,640,973**	**116,609**

The expansion state of the matrix will save with your report. Conditional formatting will only apply to the inner most visible level of the hierarchy.

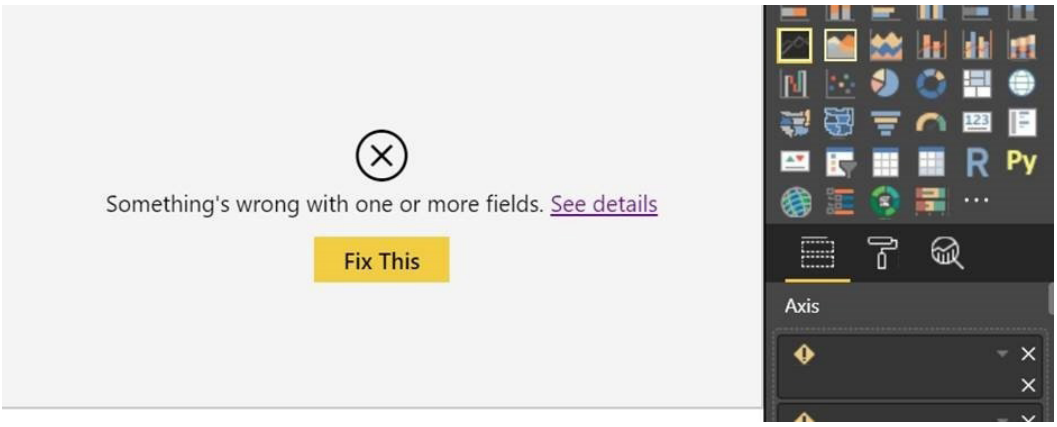
Copy and paste between desktop files

It's now possible to copy visuals between ***.pbix*** files. With this release, you may now copy a visual either through the visual's context menu or through the standard **CTRL + C** keyboard shortcut and paste it into another report through **CTRL + V**.



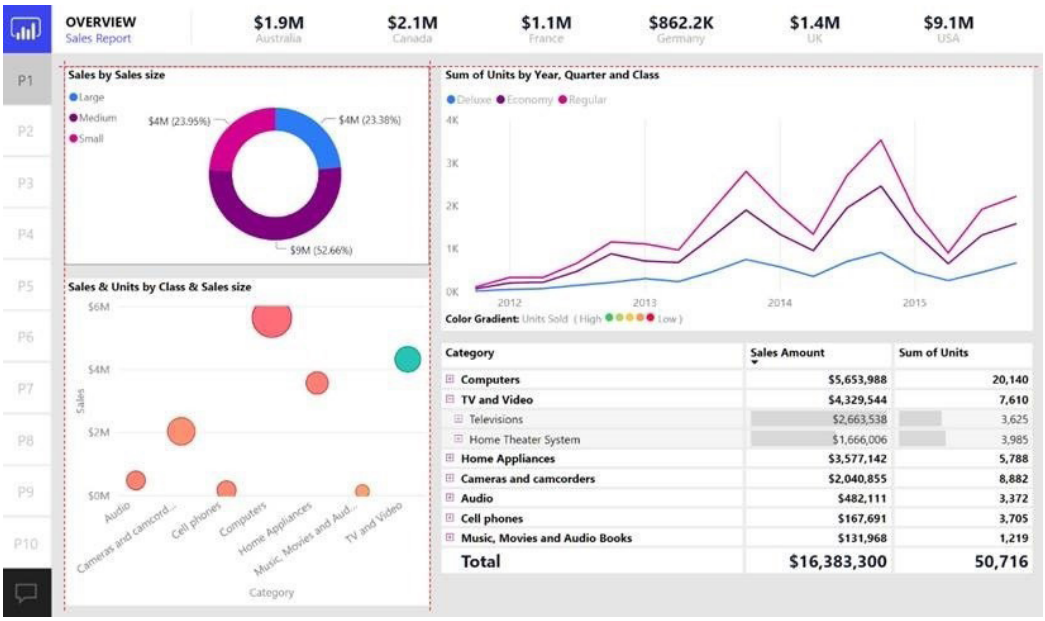
This is very useful for anyone who builds and updates multiple reports frequently. When copying between files, formatting that has been explicitly set in the 'Formatting' pane will carry forward, and anything that is relying on a theme or the default settings will update to match the theme of the destination report.

If the fields in your model are different, you'll see an error on the visual and a warning on the fields that don't exist, similar to the experience you see if you delete a field in the model a visual is using. All you'll need to do is replace the broken fields with the ones you want to use from the new model. If you are using a custom visual, you'll also need to import it to the destination file as well.



Smart guides for aligning objects on a page

You'll now see smart alignment guides when moving objects on your report page, like you see in PowerPoint, to help you align everything on your page. You'll see the smart guides any time you drag or resize something on your page. When you move an object near another one, it will snap into a position aligned with the other object.

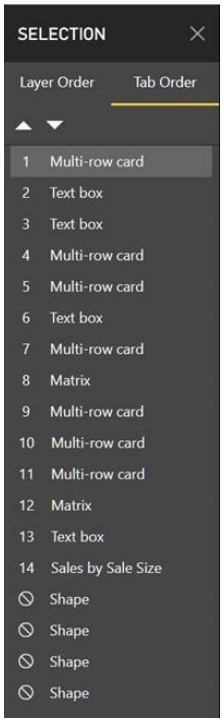


If you decide you don't want the smart guides, you can turn them off in the 'Report settings' page of the 'Options' dialog.

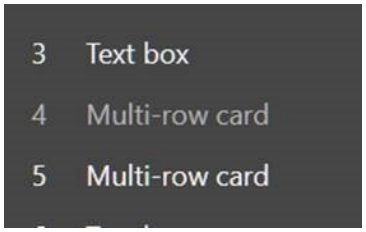
Set tab order for objects on a page

The default tab order for objects on a page is the creation order. However, you may have a specific order in mind for users to consume your report. If this is the case, you can now set your own custom tab order for the report page. To set the tab order, you can open the selection pane and switch the 'from the default Layer' order to the 'Tab' order.

You can drag and drop the fields to reorder the tab order.



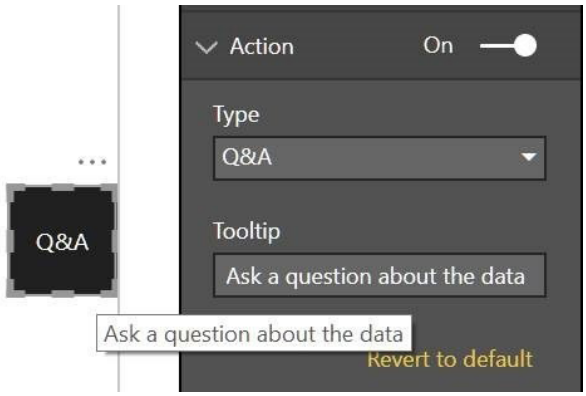
Things that are currently hidden are also dimmed in this view, since things that are hidden are automatically skipped.



You can also mark something that should be skipped in the tab order by hovering over the number and clicking the 'Skip' icon. Once you mark something to be skipped, it will never be in the tab order, even if it is visible on the report. If you have a lot of shapes on your report for purely decorative reasons, it might be a good idea to skip them.

Tooltips for button visuals

If you've used the button visuals to add navigation or information to your report, you might also want to customise the tooltip for the button. Well, you can now look in the 'Action' card of any button visual and you'll see a 'Tooltip' option. This lets you put in text that will be used in place of the '**CTRL + click here to follow link**' tooltip you see by default.

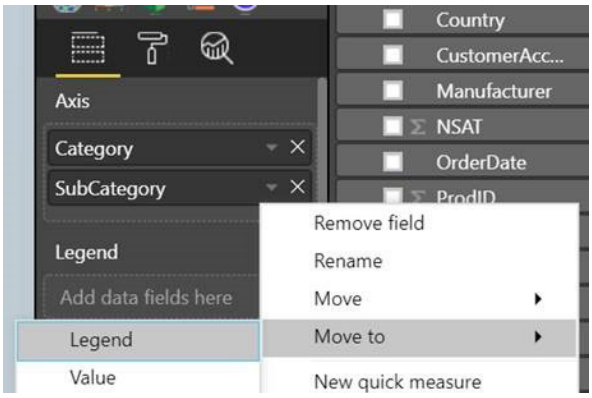


Report accessibility improvements

This release also sees a keyboard and screen reader added, to support greater accessibility for the 'Formatting' and 'Analytics' panes. If your focus is in the 'Formatting' or 'Analytics' pane, you'll be able to **TAB** and **SHIFT + TAB** between all the controls, hear useful information read out by a screen reader for any given control, and change the settings using arrow keys and **SPACE / ENTER**, depending upon the control type.

Just like any other accessibility improvement, this update improves the experience for all users as well. It is envisaged that the keyboard navigation will allow all users to work a mite faster when making many changes to a visual's formatting all at once.

This release also has improvements for the 'Field' well. This 'Field' well can now be navigated using just a keyboard and interacts well with screen readers. To help improve the usability of editing charts with screen reader and keyboard, Microsoft has also added new options to the context menu of fields to move fields up and down within a well or move to other wells.



The 'Selection' pane is also now fully accessible. This includes keyboard navigation, screen reader support and high contrast support. When using the 'Selection' pane with a keyboard, once you open the 'Selection' pane from the Ribbon, your focus will move directly to the pane. From there you can tab through all the buttons on pane. When your focus is on the list, you can press **F6** to "activate" the list and use up / down arrows to cycle through the list of visuals. While your focus is on an individual object in the 'Selection' pane list, you can use the following hotkeys:

- Select / deselect an object: **ENTER** or **SPACEBAR**
- Multi-select: **CTRL + SPACE**
- Move an object up in the layering: **CTRL + SHIFT + F**
- Move an object down in the layering: **CTRL + SHIFT + B**
- Hide / show (toggle) an object: **CTRL + SHIFT + S**.

Press **TAB** to exit the activated list and return to the top of the pane.

The 'Fields list' pane is now fully accessible. You can navigate around the pane using just your keyboard and a screen reader and use the context menu to add fields to your report page. The following keyboard shortcuts can be used in the 'Fields list':

- Move focus along the pane: **TAB**
- Select a field: **ENTER / SPACE**
- Collapse all tables: **ALT + SHIFT + 1**
- Expand all tables: **ALT + SHIFT + 9**
- Collapse a single table: **Left arrow key**
- Expand a single table: **Right arrow key**
- Open a context menu**: SHIFT + F10 or Context key.**

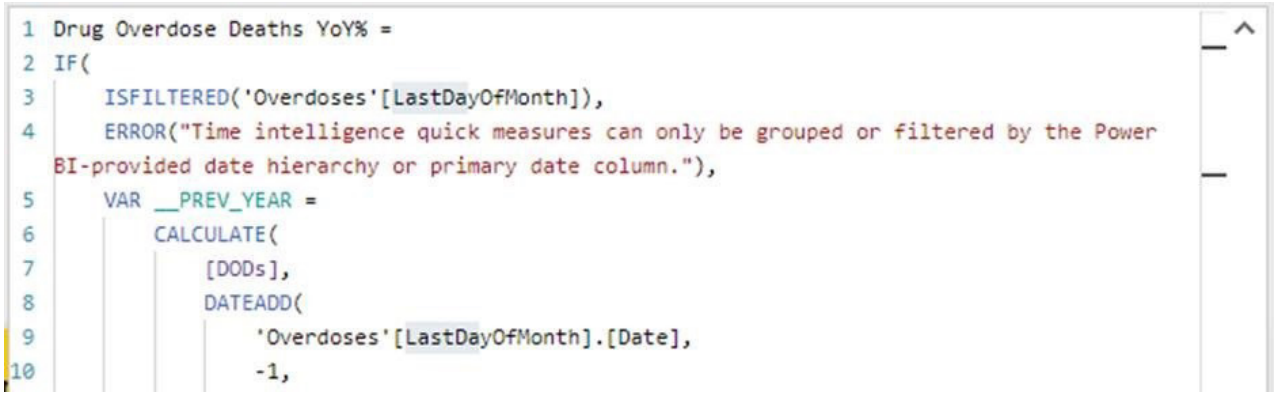
New options have also been added to the context menu to add the field to the report page, to the different filter buckets, and the drillthrough bucket. With these updates, all the panes are now fully accessible. The following experiences also fully support keyboard navigation, screen readers, and high contrast settings:

- 'Getting started' dialog
- 'File Menu' and 'About' dialog
- 'Warning' bar
- 'File Restore' dialog
- 'Frowns' dialog.

Also, this update will see users be able to navigate more quickly to different areas of Power BI Desktop through **CTRL + F6**. Instead of just jumping between visuals on a page and the page tab switcher, users may also jump to whatever panes are currently visible, the view switcher on the left and the account options on the top right, and still reach the Ribbon through pressing **ALT**.

DAX Editor improvements

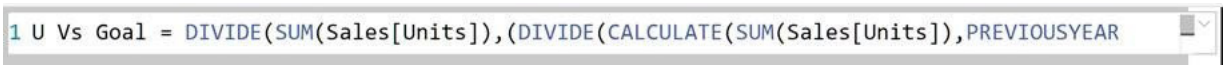
The new DAX Editor has new keyboard shortcuts, line numbers and indent lines. The experience will be very similar to what is available for other Microsoft editors, such as VS Code:



Some of the less well-known keyboard shortcuts you might find useful include:

Keystroke	What it does
ALT + Up / Down Arrow	Move line up / down
SHIFT + ALT + Up / Down Arrow	Copy line up / down
CTRL + ENTER	Insert line below
CTRL + SHIFT + ENTER	Insert line above
CTRL + SHIFT + \	Jump to matching bracket
CTRL +] / [	Indent / outdent line
ALT + CLICK	Insert cursor
CTRL + I	Select current line
CTRL + SHIFT + L	Select all occurrences of current selection
CTRL + F2	Select all occurrences of current word

Another update is that you can now zoom on the formula bar, using either **CTRL + + / -** keys or the **CTRL + Mouse Wheel**. This is very useful if the font size is too small or you need to present the DAX to a large group.



Also, you may now use a much larger view of the DAX formula bar. When expanding the DAX editor, the formula bar new takes up almost the full height of the Power BI Desktop, instead of the static 11 lines that was used previously.

Modelling accessibility improvements

The modelling experiences also have accessibility improvements this release. Microsoft has now added keyboard navigation, screen reader support and high contrast setting support to the following experiences:

- 'Manage relationships' dialog
- 'Edit relationships' dialog
- 'Manage roles dialog' for Row Level Security.

The data view is now fully accessible as well. You can navigate around areas of the data view using **CTRL + F6**. The data grid region also supports table style navigation – arrow keys to move around, **PgUp / PgDn** support, **HOME / END** and **CTRL + HOME / CTRL + END** support. You can also trigger the context and filter menus with the keyboard. The data view also supports screen readers and high contrast settings.

New DAX functions

There's three new DAX functions in this release. In support of the new expand / collapse feature for the matrix visual, there's now an additional optional **DrilldownFilter** argument for the **RollupAddIsSubtotal** function and a new **NonVisual** function. Additionally, Microsoft has added the **IsInScope** function, which is a better way to detect hierarchy level in a measure expression. Some popular tasks you might need this for include:

- Calculating child percentage of parent subtotal
- Calculating ranks of children under different parents.

Colour saturation on visuals upgraded to use conditional formatting

For quite a while now, there have been two different ways to dynamically colour a visual's data points depending on the visual type. Power BI charts had a colour saturation option in the 'Field' well that gave you basic controls, and the table and matrix visuals had conditional formatting. There have been significant functionality improvements in the conditional formatting experience for table and matrix over the last year, but the colour saturation feature has had scant improvement.

That has finally changed now as this update sees all the Generally Available visuals upgraded that had previously used colour saturation. This means users will have a similar experience to formatting tables and matrices. This means you'll have access to all three types of formatting currently available: 'Color by color scales', 'Color by rules' and 'Color by field'.

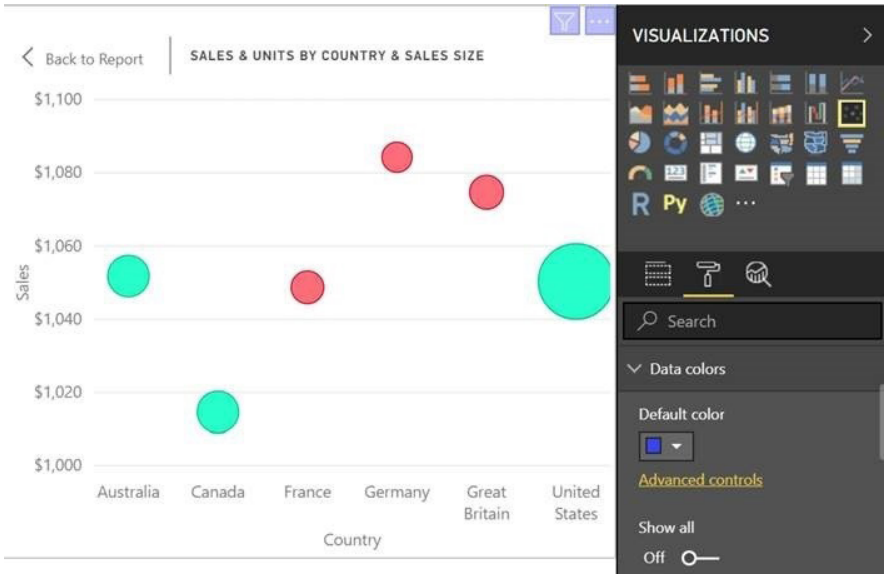
As mentioned, this change impacts all visuals which previously had colour saturation which includes:

- All variants of column and bar charts
- Funnel chart
- Bubble & filled maps
- Treemap
- Scatter chart.

With this upgrade, you'll notice the colour saturation bucket is no longer in the 'Field' well. Instead, to format, you'll go to the 'Data colors' card in the 'Formatting' pane. Here, you can format with the colour pickers as normal or select the 'Advanced controls' option to launch the 'Conditional Formatting' dialog.

Once there, you can use any of the three conditional formatting options and select 'OK' to apply the formatting.

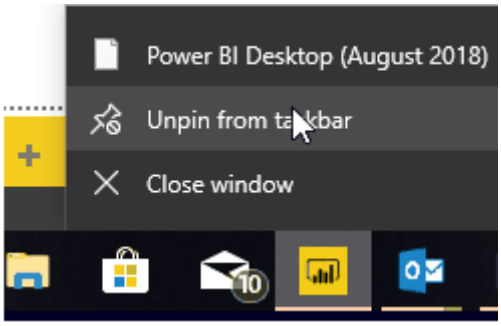
The conditional formatting colours will apply on top of whatever formatting you already have through theming and manually picking through the colour pickers.

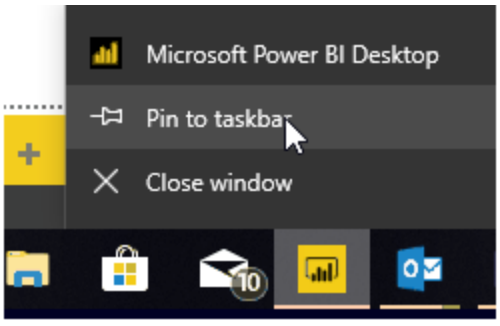


Updated Power BI Desktop for Report Server icon

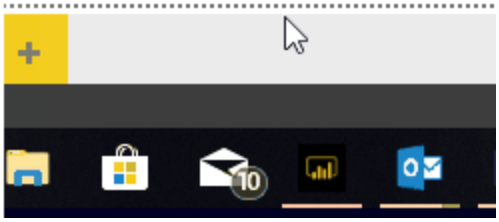
A common complaint from users of both the Power BI Report Server and Power BI Service versions of Power BI Desktop is that it's hard to tell which version they're using (you're telling us!). To help clarify matters, Microsoft has changed the Power BI Report Server version's icon to a yellow-on-black logo:

This will be displayed in shortcuts, Task Manager, *etc*. If you already have the icon pinned to your taskbar you'll need to un-pin and re-pin to update it to the new icon





Notice the icon remains black on yellow until it has been pinned:



Transport layer security settings

Security is a priority for report preparers, end users and Microsoft alike. The software giant has company-wide programs in place to ensure customers have control over the security of communications with Microsoft services. IT and network security administrators may wish to force usage of more recent versions of TLS (Transport Layer Security) for any secured communication on their network, and Power BI Desktop now respects the Windows registry keys you use to manage this.

For example, you can disable client applications from using the older TLS 1.0 by setting the following in the Windows registry:

[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\SecurityProviders\SCHANNEL\Protocols\TLS 1.0\Client] "Enabled" =dword: 00000000

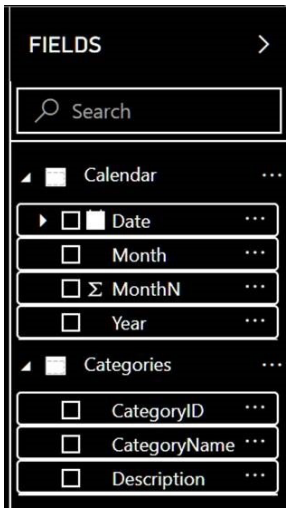
[HKEY_LOCAL_MACHINE\SYSTEM\CurrentControlSet\Control\SecurityProviders\SCHANNEL\Protocols\TLS 1.0\Client] "DisabledByDefault" =dword:00000001

Please don't touch unless you know what you are doing!

Power BI Desktop will respect the registry keys specified on those pages, and only create connections using the right version of TLS.

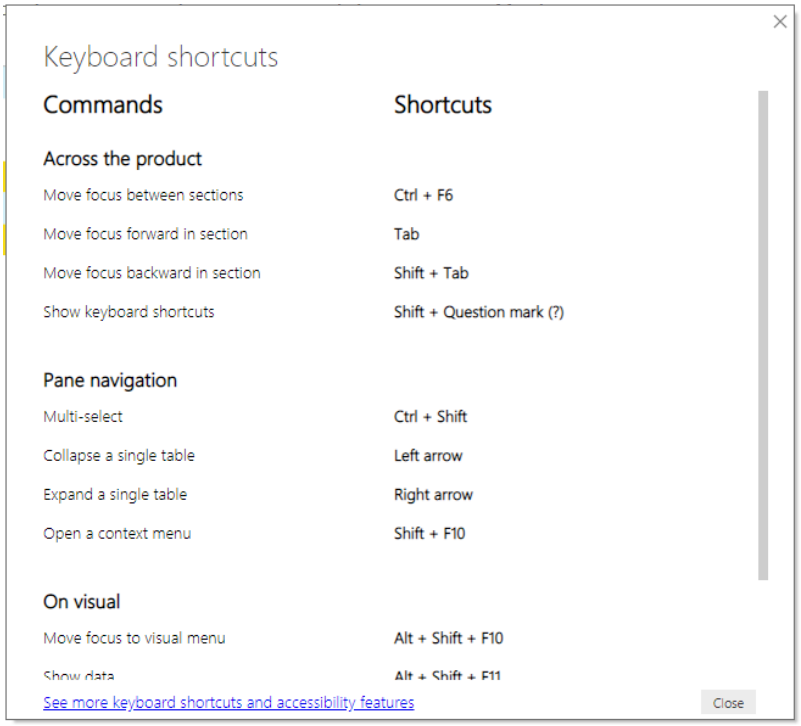
High contrast support for all panes and report footer

All the panes in Power BI Desktop, the page switcher and their contents, are now compatible with high contrast modes.



Improved keyboard shortcuts dialog

For quite some time, you could press **SHIFT + ?** to open a dialog listing several of the most used keyboard shortcuts for Power BI reports. Given all the accessibility work undertaken (especially in Power BI desktop), there's now a completely new shortcut dialog with much more helpful information in it.



Yes, we know we reported on this last month for Power BI Desktop, but hey, you can never get enough of a good thing. Therefore, with no apology forthcoming, here again is the current list of keyboard shortcuts as cited by Microsoft in various locations.

Shortcut	Action
ALT + Click	Insert cursor in DAX Editor
ALT + Down Arrow key	Move line down in DAX Editor
ALT + ENTER	New line starting from first of line in DAX Editor (no indent)
ALT + I	Restart intellisense
ALT + SHIFT + A	To comment / uncomment (toggle) a portion of code
ALT + SHIFT + Down Arrow key	Copy line down in DAX Editor
ALT + SHIFT + F10	Move focus to 'Visual' menu
ALT + SHIFT + F11	Show data
ALT + SHIFT + Right Arrow key	Select nearest word and expand selection in DAX Editor
ALT + SHIFT + Up Arrow key	Copy line up in DAX Editor
ALT + Up Arrow key	Move line up in DAX Editor
CTRL + ALT + Down Arrow key	Enter multiple lines of code at once in DAX Editor
CTRL + ALT + Up Arrow key	Enter multiple lines of code at once in DAX Editor
CTRL + C	Copy
CTRL + D	Highlight the current word, CTRL + D again to find / highlight the same next word. Continue pressing CTRL + D to find / highlight all same words, then start typing to replace all words at once
CTRL + DELETE	Delete a word in the DAX Editor
CTRL + ENTER	Insert line below in DAX Editor
CTRL + F2	Select all occurrences of current word in DAX Editor
CTRL + F6	Move focus between sections
CTRL + G	Go to line number in DAX Editor
CTRL + I	Select current line in DAX Editor
CTRL + K + C	Comment multiple lines in DAX Editor
CTRL + K + U	Uncomment multiple lines in DAX Editor
CTRL + Right Arrow key	Interact with a Slicer
CTRL + SHIFT	Multi-select
CTRL + SHIFT + B	Move an object down in the layering ('Selection' pane)
CTRL + SHIFT + ENTER	Insert line above in DAX Editor
CTRL + SHIFT + F	Move an object up in the layering ('Selection' pane)
CTRL + SHIFT + K	Delete multiple lines in DAX Editor
CTRL + SHIFT + L	Select all occurrences of current selection in DAX Editor
CTRL + SHIFT + S	Hide / show (toggle) an object ('Selection' pane)
**CTRL + SHIFT + **	Jump to matching bracket in DAX Editor
CTRL + SPACE	Multi-select objects
CTRL + V	Paste
CTRL + '+'	Comment / uncomment all lines including a desired word
CTRL + [	Outdent line in DAX Editor

Shortcut	Action
CTRL +]	Indent line in DAX Editor
CTRL + /	Comment multiple lines in DAX Editor
**CTRL + **	Uncomment multiple lines in DAX Editor
ENTER	Select or de-select an object
F6	Activate 'Selection' pane
Left Arrow key	Collapse a single table
Right Arrow key	Expand a single table
SHIFT + ENTER	Creates line break with auto-indent
SHIFT + F10	Open a context menu
SHIFT + TAB	Move focus backward in section or decrease indent (context specific)
SHIFT + ?	Show keyboard shortcuts
SPACE	Select or de-select an object
TAB	Move focus forward in section
Windows Context Key + F10	Open a context menu

That's it until the March newsletter.

The A to Z of Excel Functions: DATE

We have finally made the 'D's!!

This function returns the sequential serial number that represents a particular date. Essentially, this was one method of avoiding the "dreaded Year 2000 bug" which concerned potential division by zero errors.

The **DATE** function employs the following syntax to operate:

DATE(year,month,day)

The **DATE** function has the following arguments:

- **year:** this is required. The value of the year argument can include one to four digits. Excel interprets the year argument according to the date system your computer is using. By default, Microsoft Excel for Windows uses the 1900 date system, which means the first date is January 1, 1900. It's best to use four digits for the year argument to prevent unwanted results. For example, "18" could mean "1918" or "2018" – four-digit years prevent such confusion
    - if **year** is between 0 (zero) and 1899 (inclusive), Excel adds that value to 1900 to calculate the year. For example, **DATE(108,1,2)** returns January 2, 2008 (1900+108)
    - if **year** is between 1900 and 9999 (inclusive), Excel uses that value as the year. For example, **DATE(2008,1,2)** returns January 2, 2008
    - if **year** is less than 0 or is 10000 or greater, Excel returns the *#NUM!* error value

- **month:** this is also required and should be a positive or negative integer representing the month of the year from 1 to 12 (January to December)
  - if **month** is greater than 12, **month** adds that number of months to the first month in the year specified. For example, **DATE(2018,14,2)** returns the serial number representing February 2, 2019
  - if **month** is less than 1, **month** subtracts the magnitude of that number of months, plus 1, from the first month in the year specified. For example, **DATE(2018,-3,2)** returns the serial number representing September 2, 2017
- **day:** again, this is required. This is a positive or negative integer representing the day of the month from 1 to 31
  - if **day** is greater than the number of days in the month specified, **day** adds that number of days to the first day in the month. For example, **DATE(2018,1,35)** returns the serial number representing February 4, 2018
  - if **day** is less than 1, **day** subtracts the magnitude that number of days, plus one, from the first day of the month specified. For example, **DATE(2018,1,-15)** returns the serial number representing December 16, 2017.

It should be further noted that:

- Excel stores dates as sequential serial numbers so that they can be used in calculations. January 1, 1900 is serial number 1, and July 6, 2009 is serial number 40000 because it is 39,999 days after January 1, 1900
- you will need to change the number format (**CTRL + 1**, 'Format Cells') in order to display a proper date
- February 29, 1900 is recognised as day 60 on the 1900 date system. This date does not exist (years ending in "00" must be divisible by 400 to be a leap year), but this error has been perpetuated to be consistent / compatible with Lotus 1-2-3.

Please see the following example below:

	A	B	C
1	Description	Value	
2	Day	17	
3	Month	9	
4	Year	2018	
5			
6			
7	Description	Result	Formula
8	Date	17 Sep 2018	=DATE(B4,B3,B2)
9			

The A to Z of Excel Functions: DATEDIF

This function has been described by the late MVP Chip Pearson as "…the drunk cousin of the formula family...". The **DATEDIF** function calculates the number of days, months or years between two dates. Excel provides the **DATEDIF** function in order to support older workbooks from Lotus 1-2-3 and may calculate incorrect results under certain scenarios (*see below*). To use **DATEDIF**, you must type the function in manually; it does not appear to be recognised by Excel.

The **DATEDIF** function employs the following syntax to operate:

DATEDIF(start_date, end_date, interval)

The **DATEDIF** function has the following arguments:

- **start_date:** this is the date that represents the first, or starting, date of the period. Dates may be entered as text strings within quotation marks (for example, "17 Sep 1967"), as serial numbers (for example, 36921, which represents January 30, 2001, if you're using the 1900 date system), or as the results of other formulas or functions (for example, **DATEVALUE("1 Jan 2000")**)
- **end_date:** this is the date that represents the last, or ending, date of the period
- **interval:** this must be entered and mandates whether the function should return the number of days ("d"), complete months ("m") or complete years ("y") between the two dates specified. The syntax for the **interval** is strict: the letters must be entered between inverted commas. In fact, the interval argument can also contain a combination of days, months and years in order to increase the variety of answers returned by the function. For example:
  - "ym" – calculates the number of complete months between two dates as if the dates were in the same year
  - "yd" – calculates the number of days between two dates as if the dates were in the same year

- "md" – calculates the number of days between two dates as if the dates were in the same month and year. Be careful with this option: Microsoft knows there are issues with this combination and does not recommend you relying on the results of this **interval**.

Watch out for two common error messages with this function:

- *#VALUE!* appears in the answer cell If one of **DATEDIF** 's arguments is not a valid date (*e.g.* the date was entered as text)
- *#NUM!* occurs in the result cell if the **start_date** is larger (*i.e.* later in the year) than the **end_date** argument.

It should be further noted that:

- dates are stored as sequential serial numbers so they may be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2008 is serial number 39448 because it is 39,447 days after January 1, 1900
- The **DATEDIF** function is useful in formulae where you need to calculate an age.

Please see thr example below:

	A	B	C	D	E	F
1	Start Date	End Date	Interval	Formula	Description	Result
2	1 Jan 2018	1 Jan 2020	y	=DATEDIF(A2,B2,C2)	Two complete years in the period	2
3	1 Jun 2021	15 Aug 2022	d	=DATEDIF(A3,B3,C3)	440 days between the two dates	440
4	1 Jun 2021	15 Aug 2033	yd	=DATEDIF(A4,B4,C4)	75 days between the dates, ignoring the years of the dates	75

Known Issues

The "md" argument may result in a negative number, a zero or an inaccurate result. If you are trying to calculate the remaining days after the last completed month, you may need to revert to basic algebra using the **DAY** and **EOMONTH** (this determines the end of the month so many months from the date given) functions instead:

	A	B	C	D	E	F
7	Start Date				16 Jan 1997	
8	End Date				13 Mar 2020	
9	End of Month Prior to End Date				29 Feb 2020	=EOMONTH(E8,-1)
10	Number of Days in Prior Month				29	=DAY(E9)
11	Number of Remaining Days after Last Completed Month				26	=DAY(E8)-DAY(E7)+IF(DAY(E7)>DAY(E8),E10,0)
12						

The A to Z of Excel Functions: DATEVALUE

This function converts a date that is stored as text to a serial number that Excel recognises as a date. For example, the formula **=DATEVALUE("1/1/2020")** returns 43831, the serial number of the date January 1, 2020. Do note though that your computer's system date setting may cause the results of a **DATEVALUE** function to vary from this example.

SUN	MON	TUE	WED	THU	FRI	SAT
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30			

The **DATEVALUE** function is helpful in cases where a worksheet contains dates in a text format that you want to filter, sort, or format as dates, or use in date calculations. To view a date serial number as a date, you must apply a date format to the cell.

The **DATEVALUE** function employs the following syntax to operate:

DATEVALUE(date_text)

The **DATEVALUE** function has the following arguments:

- **date_text:** this is required and should be the text that represents a date in an Excel date format, or a reference to a cell that contains text that represents a date in an Excel date format. For example, "1/1/2020" or "1-Jan-2020" are text strings within quotation marks that represent dates
- using the default date system in Microsoft Excel for Windows, the **date_text** argument must represent a date between January 1, 1900 and December 31, 9999. The DATEVALUE function returns the *#VALUE!* error value if the value of the **date_text** argument falls outside of this range
- if the year portion of the **date_text** argument is omitted, the **DATEVALUE** function uses the current year from your computer's built-in clock. Time information in the **date_text** argument is ignored.

It should be further noted that:

- Excel stores dates as sequential serial numbers so that they can be used in calculations. By default, January 1, 1900 is serial number 1, and January 1, 2020 is serial number 43831 because it is 43,830 days after January 1, 1900
- most functions automatically convert date values to serial numbers.

Please see our final example for this month below:

	A	B	C
1	**Description**	**Value**	
2	Day	22	
3	Month	1	
4	Year	2020	
5			
6			
7	**Description**	**Result**	**Formula**
8	Serial number of a date entered as text	36,892	*=DATEVALUE("1/1/2001")*
9	Serial number of a date entered as text	36,892	*=DATEVALUE("1 Jan 2001")*
10	Serial number of a date entered as text, using the 1900 date system and the computer's built-in clock returns 2018 as the current year	43,101	*=DATEVALUE("1 Jan")*
11	Serial number of a date based on above cell inputs	43,852	*=DATEVALUE(B2&"/"&B3&"/"&B4)*
12			

More Excel Functions next month…

Upcoming SumProduct Training Courses

Location	Course	Date	Duration
Sydney	Excel Tips & Tricks	4 Feb 2019	1 Day
Sydney	Financial Modelling	5 - 6 Feb 2019	2 Days
Brisbane	Excel Tips & Tricks	11 Feb 2019	1 Day
Brisbane	Financial Modelling	12 - 13 Feb 2019	2 Days
Melbourne	Excel Tips & Tricks	19 Feb 2019	1 Day
Melbourne	Financial Modelling	20 - 21 Feb 2019	2 Days
Perth	Excel Tips & Tricks	25 Feb 2019	1 Day
Perth	Financial Modelling	26 - 27 Feb 2019	2 Days
Melbourne	Power Pivot, Power Query and Power BI	13 - 15 Mar 2019	3 Days
Sydney	Excel Tips & Tricks	1 Apr 2019	1 Day
Sydney	Financial Modelling	2 - 3 Apr 2019	2 Days
Sydney	Power Pivot, Power Query and Power BI	8 - 10 Apr 2019	3 Days
London	Financial Modelling	1 - 2 May 2019	2 Days
London	Financial Modelling	6 - 7 May 2019	2 Days

Auckland	Financial Modelling	6 - 7 May 2019	2 Days
Wellington	Financial Modelling	9 - 10 May 2019	2 Days
Melbourne	Excel Tips & Tricks	21 May 2019	1 Day
Melbourne	Financial Modelling	22 - 23 May 2019	2 Days
Melbourne	Power Pivot, Power Query and Power BI	28 - 30 May 2019	3 Days
Sydney	Excel Tips & Tricks	3 Jun 2019	1 Day
Sydney	Financial Modelling	4 - 5 Jun 2019	2 Days
Sydney	Power Pivot, Power Query and Power BI	10 - 12 Jun 2019	3 Days

Key Strokes

Each newsletter, we'd like to introduce you to useful keystrokes you may or may not be aware of. This month, we thought we ought to get a **SHIFT** on and continue with our function key theme...

Keystroke	What it does
SHIFT + F1	What is... (Help)
SHIFT + F2	Insert / Edit Comment
SHIFT + F3	Function Wizard
SHIFT + F4	Find Next (from most recent search)
SHIFT + F5	Find dialog
SHIFT + F6	Previous Pan
SHIFT + F8	Add to Selection Mode
SHIFT + F9	Calculate Sheet
SHIFT + F10	Activate Context Menus (right-click equivalent)
SHIFT + F11	Insert New Worksheet
SHIFT + F12	Save

There are over 540 keyboard shortcuts in Excel. For a comprehensive list, please download our Excel file a www.sumproduct.com/thought/keyboard-shortcuts. Also, check out our new daily **Excel Tip of the Day** feature on the www.sumproduct.com homepage.

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- **Refinancing / restructuring**
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- **Working capital management**

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Link to Others

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Any Questions?

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