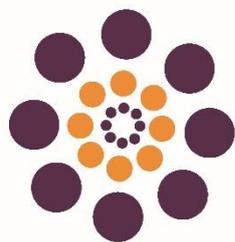


Financial Modelling in Excel (Intermediate)

Online Course Notes

Module 2 of 6

“Excel Tools”



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Specialists in Financial Modelling

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MODULE TWO: Excel Tools

Module Two consists of 4 videos:

1. Mixed Referencing and Named Ranges
2. Conditional Formatting
3. External File Links
4. Protecting, Hiding and Grouping

Log into your online course and download the Excel templates on each video page. Follow along with the video demonstration, and save your model. Note that the Excel models in Module Two are not required uploads for this course, however, you are welcome to submit them if you'd like us to check that you're on the right track.

Video 2.1: Mixed Referencing and Named Ranges

Recommended Reading: See the section on “Cell Referencing Best Practices” in Chapter 5, Page 119 as well as “Named Ranges” on Page 123 of [Using Excel for Business Analysis](#). Below is an extract from this chapter:

Mixed Cell Referencing

One of the points of best practice in financial modelling is to have exactly the same formula all the way across and all the way down the block of data. In order to do that you need to understand where the dollar signs (\$) go.

Cell Referencing Exercise

Create a single formula that can be copied to accurately calculate the following interest payments:

Borrowing	7.5%	8%	8.5%
\$250,000			
\$500,000			
\$1,000,000			

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See “Using Excel for Business Analysis”, Chap5, p119

Background: For example, let’s say you are borrowing \$250,000 at a rate of 7.5%, but want to see what interest you’d pay at different rates and different borrowing amounts.

1. Open the file called “Mixed Referencing and Named Ranges” as shown in the video
2. In cell **B2**, create a formula, using absolute referencing, that can be dragged across and down the entire block to cell **D4** in one action (without editing), hence showing the interest payable for different borrowing amounts at different interest rates.

3. Remember that if you want to anchor the row, the dollar sign goes in front of the row, and to anchor the column, the dollar sign should be in front of the column.
4. Try to do it using your keyboard shortcuts. Use the arrow keys to navigate, and toggle the F4 shortcut key to add and remove the \$. Spend a few minutes on this before watching the video to see the answer.
5. Your formula in cell B2 should look like this: **= $\$A2*B\1**
6. Copy your formula across and down the block of data so that it looks like this:

It's much better ergonomically if you can try to use your keyboard shortcuts as much as you possibly can instead of the mouse.

	A	B	C	D	E
1	Borrowing	7.5%	8.0%	8.5%	
2	\$250,000	\$18,750	\$20,000	\$21,250	
3	\$500,000	\$37,500	\$40,000	\$42,500	
4	\$1,000,000	\$75,000	\$80,000	\$85,000	
5					
6					

Note that understanding mixed cell referencing is critical for good financial modelling practice and so it's important for a financial modeller to understand mixed cell referencing. The fewer unique formulas in your model the better! Formula consistency is fundamental to best practice for a number of reasons.

Consistent formulas using mixed references are:

- faster to build and more efficient
- less prone to error
- cheaper to audit

Exercise: Creating a Capital Budget Schedule

Background: We've just had our annual budget approved, and we need to create a schedule for the next 12 months. Let's practice using our relative cell references to build this capex schedule.

1. Go to the Sheet called "Schedule" in the file called "Mixed Referencing and Named Ranges" as shown in the video
2. Calculate the total budget in column E by writing the formula **=D3*C3** into cell **E3** and copying down the range as shown
3. In cell **G3** we need to test whether the date in row 2 is the same as the date in column F. We can do this using an IF statement. Write the formula **=IF(G2=F3,E3,0)**.
4. Insert the dollar signs by using the F4 shortcut. Your formula should be **=IF(G\$2=\$F3,\$E3,0)**
5. Copy this formula across and down the table.
6. Add your total in column S, and in row 17 by using the shortcut **ALT=**

7. We know that the total cell S17 should be equal to the total in E17 and a good financial modeller is always looking for opportunities to put in error check, so in cell S18, add a very simple error check by writing formula =S17-E17.
8. Change the formatting to comma style to remove the zero and CUT and paste (not copy and paste) the formula to cell E1.

We can see that using mixed cell referencing, and using the F4 shortcut in particular, made building this model much quicker and easier than it would otherwise have been.

Named Ranges

Excel allows you to select a single cell, or a range of cells, and give it a name. You can then use the name to move to the cells and select them, or include them in a formula.

Why Use a Named Range?

Those new to named ranges sometimes struggle to see the benefits of including them in models. It's true that most of the time named ranges are not entirely necessary, but there are some good reasons to use named ranges when building a model:

Why use a Named Range?

1. Makes your formulas easier to follow
2. Don't need absolute referencing
3. Can also be used in Macros
4. Should use named ranges when linking to external files

1 -3 make life easier, but 4 is critical



Creating a Named Range

Background: We have used an absolute reference to anchor our formula to the consistent price of \$450.

9. Go to the Sheet called "Named" in the file called "Mixed Referencing and Named Ranges" as shown in the video
10. Select cell B2 and look at the Name box in the top left-hand corner. This cell is called B2, and this won't change; however, we can also change the name of it to something else.

11. Go to the Name box in the top left-hand corner and type over the name as shown in the video. Call it something else, like Price, and press Enter. Alternatively, you can select Define Name from the Defined Names group on the Formulas Tab, but typing over the cell reference in the name box is faster.

Note that the name must not contain any spaces or special characters. For instance, if you want to call it Year 1 Price, you'd need to call it Year1Price or Year1_Price.

Named ranges don't necessarily need to be confined to only a single cell; you can also create named ranges for an entire range of cells, and these can be used in formulas. Simply highlight the range instead of a single cell, and type over the name as shown above.

About Named Ranges

- Can't use spaces or special characters in a Named Range
- Use the Name Manager to edit
- Can use dynamic Named Ranges



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See "Using Excel for Business Analysis", Chap5, p122

Video 2.2: Conditional Formatting

Recommended Reading: See the section on “Conditional Formatting” in Chapter 7, page 193 of [Using Excel for Business Analysis](#)

Exercise: Automatically Highlighting Large Variances in Reporting

Background: We’d like to highlight any large variances so that they automatically change colour as the numbers change.

Exercise:

1. Open the file called “Conditional Formatting” as shown in the video.
2. Select the first tab called “CF P&L” and highlight the range **F6:F73**
3. Select the Conditional Formatting Icon on the Home Tab, Highlight Cells Rules and then Between
4. Edit the fields to format the cells which fall between -30% and 30% as shown in the video, leave the default colour as Light Red Fill with Dark Red Text, and press OK
5. This gives us the *opposite* of what we want to show, so we are going to edit this by going back into Conditional Formatting, select Manage Rules, select the rule that you have just created and select Edit Rule
6. Change the rule so that instead of “between” it highlights the cells “not between” instead
7. Test that your conditional formatting works by changing one of the values in the report, for example, go to cell **C6** and change the value to \$310,000 instead which is an acceptable amount, and we can see that the red conditional formatting will disappear

Exercise: Graphically show Magnitude of Values on a Report Using Data Bars

Background: We are trying to decide between showing data as a chart or as a table on our report, to give our numbers a little more meaning.

Exercise:

1. Go to the file “Conditional Formatting” and select the sheet called “Data Bars”, as shown in the video
2. Highlight the range **D4:D35** and select the Conditional Formatting Icon on the Home Tab
3. Select Data Bars, and then choose the bar you’d like to show on the report
4. Test your data bars by changing one of the values, for example, go to cell **C4** and change the value from \$400,000 to \$40,000. We can see that this changes the distribution of the data bars throughout the column.

Exercise: Adding Visual Interest using Colour Scales

Background: Let's jazz up an otherwise boring report using some basic conditional formatting and colour scales.

Exercise:

1. Go to the file "Conditional Formatting" and select the sheet called "Colour Scales", as shown in the video
2. Highlight the range **B3:M7** and select the Conditional Formatting Icon on the Home Tab
3. Select Color Scales, and then choose the colour scale you'd like to show on the report
4. We can edit the colours shown by going back into Conditional Formatting, selecting Manage Rule, and then selecting the rule that you have just created and selecting Edit Rule. Change the colours to your desired selection.

Now let's apply some informative colour to the next block of data below. We cannot apply data bars, colour scales or icon sets to this data because it contains text instead of numbers, but we can still apply colour using standard conditional formatting.

5. Highlight the range **B10:M14** and select the Conditional Formatting Icon again. Select Highlight Cells Rules and then Equal To.
6. In the field type OK and change the colour in the drop-down box to green. This will change all the cells with a value of "OK" to green.
7. Let's do the same thing for the next one. Create another rule for when the cells are equal to "Too Hot", and select Light Red Fill with Dark Red Text (this step is not shown in the video).
8. Now we will create the last rule for when the cells are equal to "Too Cold" and we'd like to change the colour to blue. This colour does not exist in the pre-set options however, so we will need to select Custom Format... and manually select a blue background and font colour.
9. Test your formatting now by changing either of the Min or Max Temp values, for example, change the Max Temp in cell **P3** from 25 to 20 and watch the formulas and colours change.

Using Conditional Formatting can quickly and easily provide a little more meaning to the outcome of our model. Automatically changing colours can really add an extra element of depth and meaning to your model.

Video 2.3: External File Links

Recommended Reading: See the section on “Linking to External Files” in Chapter 4, page 83 of [Using Excel for Business Analysis](#). Below is an extract from this chapter:

Linking To External Files

One of the important principles in Excel modelling best practice is to link to the source data. Wherever possible, hard coding should be avoided, and you should always try to link your cells so that as variables change, the results remain accurate.

However, if your source data exists in an external file, this can cause many problems, such as broken links, incorrect data, and error messages. In fact, some analysts avoid linking to external files at all costs! However, if done properly, external links add value to your models.

Why you should Link to External Files

- It's best practice
- Your numbers are auditable
- The numbers will automatically update
- It saves time



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See “Using Excel for Business Analysis”, Chap4, p83

The table below shows the problems and solutions as to why many analysts don't link to external files.

Why Analysts don't Link to External Files

Problem	Solution
The links break	<ul style="list-style-type: none"> • Avoid moving files • Use 'edit links' to fix • Use named ranges to minimise number of formulas to fix
People move the data and my formulas are wrong	<ul style="list-style-type: none"> • Use named ranges to refer to external files, which will minimise this. • Use more robust formulas such as INDEX & MATCH
The numbers keep changing	Yes they should. Consider saving in one location to maximise version control.

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See "Using Excel for Business Analysis", Chap4, p83

Why You Should Use Named Ranges in External Links

One of the main issues with linking to external files is that if users insert or delete rows or columns in the source file, this can easily mess up the files that are linking to it.

Imagine you want to use a pricing threshold in your financial model, which is being generated in another model. Using best practices, you decide to create a link, rather than hard coding the number. This will make your model more auditable so that we can see exactly how that threshold amount was calculated. You create a link from your financial model to another source file, using the link:='C:\Plum Solutions\Clients\Transactions\Files\[Financial Statements.xlsx]July'!\$C\$46

If you are using Excel for Mac 2011, your file name might look more like this:

=MacintoshHD:Users:plumsolutions:Dropbox:Clients:Transactions:Files:[Financial Statements.xls]July'!\$C\$46

If both files are open at the same time, and you insert a row in the Financial Statements file, the link will automatically update from **ŠCŠ46** to **ŠCŠ47**. However, if your file is closed, your model will not update. This means that next time you open it, your model will be picking up the wrong cell!

The way around this issue is to create a named range in the source file (for example, **threshold**) and then if that cell moves in the source file, the cell will still retain its name, and the formula in your model will still be correct. See “Named Ranges” in Chapter 5 for how to do this.

=‘C:\Plum Solutions\Clients\Transactions\Files\[Financial Statements.xlsx]July’!threshold)

The next time your model tries to update the link, it will look for the name **threshold**, rather than **ŠCŠ46**, and the integrity of the link will be maintained. This is why using named ranges when dealing with external links is considered best practice; it a much more robust way of linking files together.

Dealing with Links and the Potential Errors They Can Cause

If you have linked two files together, you should not start moving either of the files around into other drives or directories. If you do, Excel will not be able to find the file that has been moved, and the link will be broken. If a file *has* been moved or had a name change, you can try to amend this by using Edit Links as described in the following text.

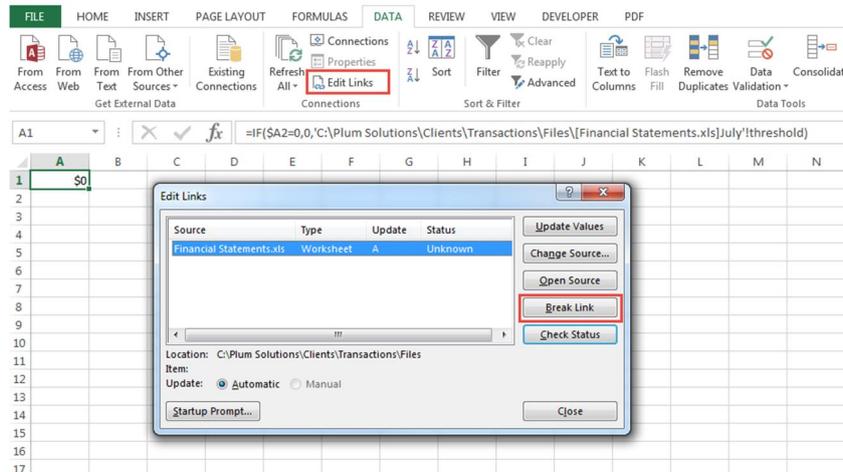
Before you start linking workbooks together you need to think about what will happen to the workbooks in the long term. Will other people be using them? Will they be making copies? Will they be mailing copies to other people? If so, then perhaps in that case, you should avoid creating a link to an external spreadsheet.

Tip

Another handy use for Edit Links is to break all links in a file. If you are e-mailing a file, it is not recommended that you leave links in it. You could paste the cell values one by one, but breaking links will convert every single formula in the entire file to their hard-coded values. Click on Edit Links, and then you will be able to select the external files and click on the Break Links button. See the image below:

How To Edit Links

1. Click on Edit Links on the Data tab, in the Connections group.
2. In Excel for Mac 2011, go to Edit, then select Links.
3. Use the Change Source button to tell your model the new location of the file it has been linked to.



Break Link Dialog Box

Linking Do's and Don'ts

Here are some common do's and don'ts to keep in mind when linking:

Linking Dos and Don'ts

- Do use named ranges when linking to external files
- Don't email files which contain links. Save another version, and use "break links" in this case
- Don't change file names and sheet names unless you really need to

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See "Using Excel for Business Analysis", Chap4, p83

Video 2.4: Protecting, Hiding and Grouping

Recommended Reading: See the section on “Bullet-Proofing your Model” in Chapter 7, page 204 of [Using Excel for Business Analysis](#). Below is an extract from this chapter.

If your model is publicly available, or if you have a lot of users entering data into it (*especially* if their Excel skills are questionable), it's a good idea to spend some time protecting it and making sure that all your hard work is not inadvertently corrupted!

Methods of Model Protection

Once you have completed building your model, there are three basic layers of protection you can include:

1. **Protect the file** so that no one can open it without the password.
2. **Protect the structure** of the workbook so that no structural changes can be made (normally used for hiding sheets and restricting access to them).
3. Unlock individual cells on the worksheet and then **protect the sheet** so that only those cells that are unlocked can be changed.

Protecting the structure or worksheets can be done with or without a password. Passwords are case-sensitive.

Warning: Bear in mind, that passwords can be hacked reasonably easily. Note that there are programs out there that can decode a password. (Try typing “Crack Excel password” into Google sometime.) If your file contains highly sensitive information, do not rely on passwords in Excel. Password protection is intended to be a deterrent, not a definitive solution.

Creating a Bullet-Proof Currency Calculator

Background: We'd like to create a calculator that will automatically convert \$AUD into regional currency based on the region we have selected.

1. Open the “Protecting, Hiding and Grouping” file as shown and select the “Drop-down” sheet
2. In cell **A2**, create a Data validation drop-down list based on the Locations in column G as shown
3. Create a formula in cell **B2** which will pick up the currency of whichever location has been selected in the drop-down list. Your formula should be **=VLOOKUP(A2,\$G\$2:\$I\$8,2,0)**
4. Copy the formula in cell **A2** to cell **D2**
5. Edit the formula so that it picks up the corresponding rate for the currency that has been selected. Your formula in cell **D2** should be **=VLOOKUP(A2,\$G\$2:\$I\$8,3,0)**
6. Now divide the price by the currency exchange rate. The formula in cell **D2** should now be **=C2/VLOOKUP(A2,\$G\$2:\$I\$8,3,0)**
7. Change your formatting, and test by changing the drop-down to see if the rates change

Protecting, Hiding and Grouping on a Staffing Budget Model

Background: We're creating our departmental budget and we'd like to forecast how much our staff will cost us based on their start dates.

1. In cell **D3**, calculate the staff costs with the formula **=C3*B3** and copy it down
2. In cell **F3** we now need to calculate their costs using an IF statement. Your formula should be **=IF(F\$2>\$E3,\$D3/12,0)**. Copy it across and down the block of data.
3. Add your totals in column R and in row 7

Now, the way we have built this, it will allow the user to enter any date in column E. We don't want this to happen because the way our formula works it will only calculate from the start of the month, so we need to restrict the user entry in column E.

4. Change cells **E3:E6** so that it will only allow the dates that have been entered into our schedule. We can do this using a data validation drop-down box like the one shown below:

	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P	Q	R	S
1	New Staff Budget 2017																		
2	Costs	HeadCount	Annual Salary	Staff Costs	Last Updated:	Start Date:	Jan-17	Feb-17	Mar-17	Apr-17	May-17	Jun-17	Jul-17	Aug-17	Sep-17	Oct-17	Nov-17	Dec-17	Total
3	Project Manager	1.00	\$240,000	\$240,000	Sep-17	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$20,000	\$20,000	\$20,000	\$60,000
4	Business Analyst	2.00	\$120,000	\$240,000	Jan-17	\$0	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$20,000	\$220,000
5	Call Centre	5.00	\$56,000	\$280,000	Sep-17	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$0	\$23,333	\$23,333	\$23,333	\$70,000
6	Product Development	1.00	\$220,000	\$220,000	Mar-17	\$0	\$0	\$18,333	\$18,333	\$18,333	\$18,333	\$18,333	\$18,333	\$18,333	\$18,333	\$18,333	\$18,333	\$18,333	\$165,000
7	Total Cost					\$0	\$20,000	\$20,000	\$38,333	\$38,333	\$38,333	\$38,333	\$38,333	\$38,333	\$38,333	\$81,667	\$81,667	\$81,667	\$515,000

5. Now I'd like to enter in a formula that will show when this budget was last updated. In cell **F1**, enter the formula **=TODAY()**.
6. We can stop people from entering a date in the future with a data validation as shown below:

7. Test this by trying to enter a date way in the future

The next thing I'd like to do is to make this model a little more discreet by not showing the staff salaries. It's not very good practice to simply hide the columns; and it's much better modelling practice to **group** the columns instead so that we can see that there are hidden columns.

Alternatively, we could move the confidential data to another page.

1. Remove any grouping you may have inserted, highlight columns C and D, and cut and paste these columns to columns B and C in the next sheet as shown
2. Go back to the "Staff Budget" sheet, and delete columns C and D which are no longer being used
3. We can now hide the "Salaries" by right-hand clicking on the tab, and selecting Hide
4. To make it even more robust, protect the structure of the workbook by selecting Protect Workbook from the Review Tab on the Ribbon. A password is optional.
5. If you would like to protect the sheet itself, select the cells you would like to be changed (such as cells **B3:C6** on the "Staff Budget" sheet), right-hand click, Format Cells and under the Protection tab, untick the Locked tick box.
6. When you select Protect Sheet from the Review tab on the Ribbon, the entire sheet will be protected, with the exception of the cells which have been changed.

Be sure to CUT and paste, not copy and paste, as this way the formula links will follow

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