Introduction to Financial Modelling in Excel

Online Course Notes

Module 2 of 4

"Fundamental Excel Tools"

Contents of this Module:

MODULE TWO: Fundamental Excel Tools

Module 2 consists of six videos:

- Linking for Best Practice
- Absolute & Relative Cell Referencing
- Calculating Project Costs
- Logical Nested Functions Part 1
- Logical Nested Functions Part 2
- Assumptions Documentation Methods

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: Linking for Best Practice

Recommended Reading: See the section on "Linking, Not Hard-coding" in Chapter 3, Page 56 of Using Excel for Business Analysis

Background: We have some simple Profit and Loss calculations, and we're going to create a summary report by linking between sheets.

Exercise:

1. Open the file called "Linking for Best Practice" as shown in the video (a completed version is also available which you can download at the end if you wish to compare your work)
2. Go to the tab called P&L, and select the cell **C4** and calculate the sales revenue by adding the formula **=F3*F4**. Your answer should be $29,502.
3. Go to cell **C19** and calculate the manufacturing cost by adding the formula =**F19*F3**. Your answer should be $7,152.
4. Go to cell **C20** and calculate the sales commission by adding the formula **=F20*C4.** Your answer should be $1,475.
5. Change the number formatting to currency with no decimal places if necessary
6. Check that the profit margin is calculating correctly. Your answer in cell **C25** should be 20%.

Now we have our detailed P&L and we can then create a summary on the front tab using links.

7. Go to the front tab called "Summary", and select cell **B5.**

8. Link through the fixed costs by adding the formula **='P&L'!C15**. Do NOT type this out. Click on cell **B5**, hit the equal sign and select the next tab using the mouse. Click on cell **C15** of the P&L tab using the mouse, and hit enter.
9. Similarly, select cell **B6** on the "Summary" tab and then link through the variable costs by adding the formula **='P&L'!C21**
10. Then go to cell **B4**, and link through the sales revenue by adding the formula **='P&L'!C4**

A good layout for a financial model is to have output at the front, calculations in the middle, and assumptions or input data at the back. We'd like to move our Assumptions now to a separate sheet at the back of the model.

11. Insert a new sheet by clicking on the plus or "Insert Worksheet" symbol behind the last tab. If you are using previous versions of Excel, you may need to right-hand click on the last tab, and select "Insert".
12. Double-click on the tab name, and rename "Sheet1" to "Assumptions"
13. Go back to the "P&L" sheet and highlight the area of the sheet which contains the assumptions eg. cells **F1:H22**
14. Hit Control+X to cut the data onto the clipboard [Command + X for Mac Users]
15. Go to the "Assumptions" page, select cell **A1** and hit Control+V or Enter to paste the data to the new sheet [Command + X for Mac Users]

Note that the formulas in this model work in exactly the same way as they did before we moved the assumptions to the new sheet. It's important that we used CUT and paste here, not COPY and paste, or the links would not have worked properly.

16. We can now go back to the "Assumptions" sheet and tidy it up. Remove the blank rows 5 to 18 by highlighting the rows, right-hand click and press Delete.

We now have a nice tidy model that follows best practice. It links, it's clear, is straightforward and easy for someone else to understand.

Video: Absolute, Relative and Mixed Cell Referencing

Recommended Reading: See the section on "Cell Referencing Best Practices" in Chapter 5, Page 119 of Using Excel for Business Analysis

Formula consistency is critical for fundamental best practice both in financial modelling and (any other sort of analysis using Excel, for that matter!) In order to have consistent formulas across and down the block of data, you need to understand how cell referencing works. Whilst this is a very basic feature of Excel that is taught in introductory Excel courses, it is surprising how many modellers don't understand its importance.

The $ sign in a cell referencing tells Excel how to treat your references when you copy the cell. If there is a dollar sign in front of a row number or column letter, the row or column does not change when you copy it. Otherwise, it does change. So an absolute reference will not change its cell reference when you copy it, whereas a relative reference will.

Background: Let's create a simple calculation which looks at various units at a single price.

Exercise:

1. Open the file called "Absolute & Relative Cell Referencing" as shown in the video
1. Go to cell **B3** and calculate the price for 5 units at $450 each by adding the formula **=A3*B2**. You can do this by hitting the equal sign, and then clicking on each cell with the mouse, or alternatively, use the up and down arrows (↑↓).
2. Copy this down (using the double-click in the bottom right-hand corner) and you'll notice that formulas do not give the correct result. These cell references will change as you copy the formula down, because they are *relative cell references.*
3. Go back to cell **B3** and use the F2 shortcut to edit the formula. [Control+U for Mac users]
4. Use the F4 shortcut to add in the dollar signs. [Command+T for Mac users]
5. Your formula in cell **B3** should now be **=A3*$B$2**. This means that the B2 part of the formula is now anchored, and will not change no matter where the formula is copied to. This is called an *absolute reference.*
6. Copy the formula back down the range again

Knowing the difference between an absolute reference and a relative reference is an important point for financial modelling for accuracy and it's also going to save you a huge amount of time as you build your model.

Video: Calculating Project Costs

Now that we are comfortable with linking, and know how to use our relative and our absolute cell referencing, let's apply that to a very simple financial model.

Background: We have been given the annual salaries for staff members who will work on a particular project. Assuming each person works 260 days in the year, (net of leave, sick days etc.) and assuming each person must work 60 days on this project, calculate the total staff cost of this project.

Exercise:

1. Open the file called "Calculating Project Costs" as shown in the video
2. Go to cell **C6** and enter the formula =**B6/B3**
3. Copy the formula down the range **C6:C9**
4. This causes an error, so go back to cell **C6**, hit F2 and then F4 to apply the absolute referencing [Control+U and then Command+T for Mac Users]
5. Copy it down the range again

Now we need to calculate what those project costs are based on the daily rate.

6. Go to cell **D6** and enter the formula **=$D$3*C6**
7. Copy it down the range
8. Go to cell **D10** create a SUM formula **=SUM(D6:D9)** and the result should be $146,769 which is the total project cost
9. You can now perform some sensitivity analysis by changing the number of project days in cell **D3** from 60 to 65, or change the cost for the Business Analyst in cell **B7** from $120,000 to $150,000 and see the effect it has on the project costs

Video: Logical Nested Functions Part 1

Recommended Reading: See the section on "Logical Functions" in Chapter 5, page 112 and "Nesting" on page 115 of Using Excel for Business Analysis

Exercise: Basic IF Statement in a Valuation Example

Background: The first tab contains a detailed valuation for a business and we want to know if we should go ahead with the project or not. Should we accept or reject the deal? If the value of the deal is more than the cost of the deal, I should go ahead and if the value of the deal is less than what it's going to cost you then you would reject the deal.

Exercise:

1. Open the file called "Logical Nested Functions" as shown in the video (a completed version is also available which you can download at the end if you wish to compare your work)
2. Select the first tab called "Valuation" and go to cell **B29**
3. Insert function using one of the various methods shown in the video. Use the function wizard, or simply type out the formula.
4. Your formula in cell **B29** should look like this: **=IF(B27>B28,"Accept","Reject")**

Exercise: Nesting IF Statements for Maximum and Minimum Temperature Ranges

Background: I'm trying to plan my holidays and I've created a list of temperature at different times of the year, in various locations around the work. I'd like to be able to see at a glance where I should go at what time of the year for my holidays!

Exercise:

1. Go to the second tab of "Logical Nested Functions" called "Nested IF", as shown in the video
2. Go to cell **B10**, and add an IF statement to assess whether or not the London is too cold in January. Your formula should be: **=IF(B3<P2,"too cold","OK")**
3. Click on the formula anywhere near the P2 reference, and use your F4 shortcut [Command+T for Mac users] to fix P2 such that it is an absolute reference. This way, as we copy the formula the reference to the minimum temperature will remain the same. Your formula should look like this: **=IF(B3<$P$2,"too cold","OK").**
4. Copy the formula across and down the block of data

We can see that the only time we can visit London is between June and September. Now we'd like to add in another condition for the maximum temperature.

5. Go to cell **B16**, and add another IF statement to assess whether or not the London is too *hot* in January. Your formula should be: **=IF(B3>$P$3,"too hot","OK")**
6. Copy the formula across and down the block of data

Now that we've got these two formulas working independently, we can put the two of them together.

7. Go to cell **B16**, double-click on the cell, and highlight all of the formula with the exception of the equals sign, as shown in the video.
8. Hit Control+C to copy it onto the clipboard, and hit escape [Command+C for Mac users]
9. Go to the original formula in cell **B10**, highlight the "OK" part of the formula, and hit Control+V, which will replace the "OK" with the second IF statement. [Command+V for Mac Users]
10. Your formula should look something like this: **=IF(B3<$P$2,"too cold",IF(B3>$P$3,"too hot","OK"))**
11. Copy it down and across the block of data
12. We can now remove the second block, as it is no longer needed. Highlight cells **A16:M20** and press delete.
13. Try changing the minimum and maximum temperatures and see how that changes our model

Video: Logical Nested Functions Part 2

Recommended Reading: See Logical Nested Functions Part 1 above.

Exercise: Nesting IF Statements to Calculate Volume Pricing Breaks

Background: This is a little more of a financially related example. Let's say you've got 63 items and if they purchase up to 5 items, it costs $15. If it's between 6 and 50 items, its $12 and if it's 51 to 150 items its $10.50 each. There's a few ways of doing this. If you have lots of tiers in a table you might consider using a VLOOKUP or something a little bit trickier. We're going to do a simple nested IF statement exactly like what we just did with our temperature example just to get a little more practice.

Exercise:

1. Go to the file "Logical Nested Functions" and select the Sheet "Pricing Table" as shown in the video
2. Go to cell **B8** and add the formula **=IF(A8<=B3,C3,C4)** to handle the first two conditions of our pricing table. If the number of items is less than or equal to 5, the formula will return $15, otherwise it will return $12.

We are going to use the same technique as we used in the temperature example, by putting the next formula in a separate cell, getting them working independently and then nesting them together at the end.

3. Go to cell **B9**, and enter the formula **=IF(A8<=B4,C4,C5)**
4. Go into the formula in cell **B9**, highlight the whole thing except for the equal sign, hit Control+C, and then escape, leaving the copied formula on the clipboard [Command+C for Mac Users]
5. Go back into the formula in cell **B8**, and highlight the last part of the formula, **C4**
6. Press Control+V to replace the "value if false" part of the formula with the second IF statement [Command+C for Mac Users]
7. Clear the formula in cell **B9** as it is no longer necessary
8. Test your formula by manually changing the value in cell **A8**
9. Calculate the total price in cell **C8** by adding the formula **=B8*A8**

You now have a dynamic, working financial model.

Exercise: Using an OR Statement to Identify Account Codes in a Range

Background: We have a list of account codes and we'd like to apply transfer pricing to only certain accounts.

Exercise:

1. Go to the file "Logical Nested Functions" and select the sheet called "OR", as shown in the video
2. Select cell **D3** and test whether or not the account code in cell **A3** is equal to the account code in cell **G3** by using the formula **=A3=G3**. The formula will return the result FALSE, because the two cells are not equal to each other.
3. Add absolute referencing to the **G3** part of the formula, so that your formula shows **A3=$G$3**, and copy it down the block of data. There should just be one cell which shows that the condition is TRUE.
4. Now we can add an OR statement by using the formula wizard as shown in the video, or by simply typing the formula **=OR(A3=$G$3,A3=$G$4,A3=$G$5)** in cell **D3**, and copy it down. This will now test whether any ONE of these three account code are listed in column A. There should be three cells which return a TRUE value.

Remember that the value TRUE is equal to the value of one as far as Excel is concerned, and FALSE is a zero. We can now use this in our formula because if you multiply a value by a TRUE it will show the value, and if you multiply it by a FALSE, it will show a zero.

5. Use this technique to complete our formula and multiply our formula so far with the values in column C. Your formula in cell **D3** should now look something like this: **=OR(A3=$G$3,A3=$G$4,A3=$G$5)*C3**
6. Copy it down the block of data, and add a total at the bottom

As with any of these simple but dynamic models we are creating today, if any of the inputs change, the output of our model will change as well.

Exercise: Nesting an AND Function to Show Values Within a Financial Year

Background: We have a list of capital expense items and we'd like to only pick up the costings if their spend date falls within a particular financial year.

Exercise:

1. Go to the file "Logical Nested Functions" and select the sheet called "AND", as shown in the video
2. Firstly, we'd like to identify whether the first spend date is greater than or equal to the start date. Select cell **D4** and enter the formula **=B4>=$B$1**.
3. The answer will be TRUE. Copy this formula down the range.
4. Let's now add the end date by editing the formula to: **=AND(B4>=$B$1,B4<=$B$2)**. This formula will return a TRUE value if the spend date falls between the two dates, and it will return a FALSE value if it does not.

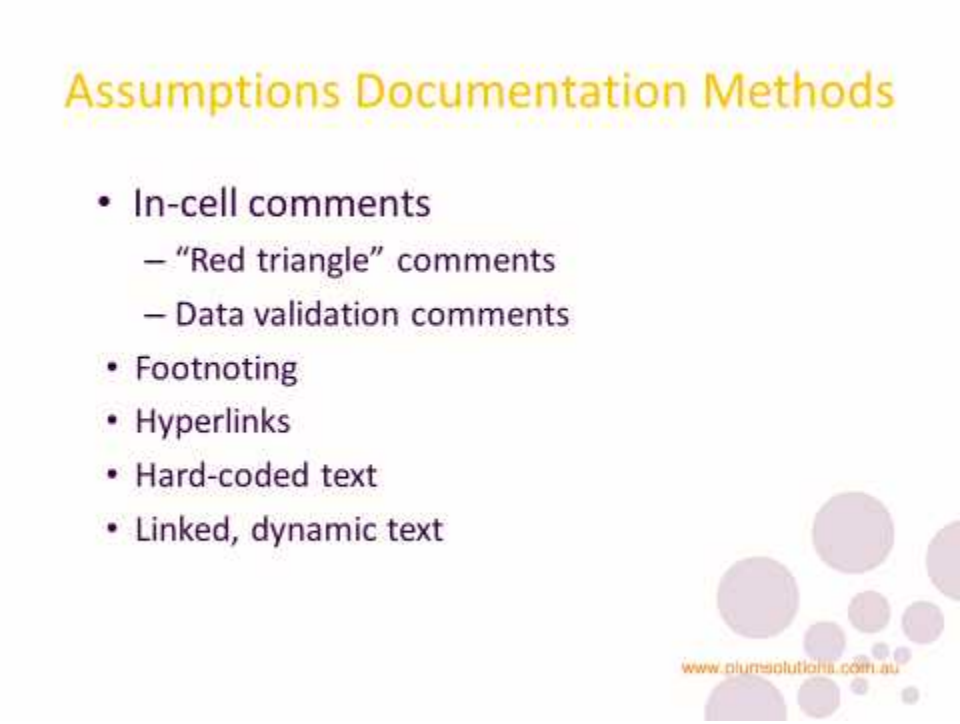
5. In exactly the same way as we did last time let's multiply our TRUE and FALSE values by the costs in column C. Your formula in cell **D4** should be **=AND(B4>=$B$1,B4<=$B$2)*C4.**
6. Copy it down the range

Nesting these logical functions such as the IF statement, the AND and the OR and nesting those together is a technique that you will find very useful throughout all of your financial modelling.

Video: Assumptions Documentation Methods

Recommended Reading: See the section on "Methods and Tools of Assumptions Documentation" in Chapter 3, page 59 of Using Excel for Business Analysis

From a technical perspective there are a number of ways in Excel of documenting what those assumptions are. Let's go through some of those different methods.



Open the file "Assumptions Documentation Methods" as shown in the video.

In-Cell Comments

"Red Triangle" Comments

1. Select cell **B3**, right-hand click on it, and select Insert Comment
2. Type in the source of where the data came from, and then click away from the comment
3. When the mouse hovers over the cell, the comment appears

These types of comments do look a little messy, they don't print very well and aren't visible unless the mouse hovers over the cell.

Data Validation Comments

1. Select cell **B5**
2. Go to the Data Tab on the Ribbon, and select Data Validation from the Data Tools group
3. Select the second tab called "Input Message" and enter your comments, including a title to appear at the top of the message, and press OK. [This works in the same way for Mac Users]
4. Click away from the cell, and when you select cell **B5** again, the message appears

These types of data validation comments are more discreet and are most appropriate for instructional types of messages, or reminders for the user.

Footnoting

It *is* possible to go into Page Setup and put footnotes into the Header/Footer section of the page but this method is rarely used in financial modelling because it is only visible in Print Preview or once the sheet has been printed. It is more common to create number references in a cell, and change the format of the cell to italic and superscript, hence manually creating a footnote in the model.

1. Go to cell **H4** and type in a 1. Right-hand click, select Format Cells and on the Font tab, select superscript and italic as shown.
2. Add the 1. to the beginning of the text in cell **A6** such that the text now says *1. nb: growth rate does not change over time*

Hyperlinks

If your source data exists as a webpage, or if you want to create a source reference to another file, then hyperlinks are a useful method of assumptions documentation. If it's a webpage, simply copy the URL and paste it directly into a cell.

To reference other parts of the model, or other files, it is possible to insert hyperlinks using the Hyperlink Icon on the Insert Tab in the Ribbon.

Hard-coded Text

Whilst good financial modelling practice does not recommend hard-coding numbers, hard-coding text assumptions is fine.

For example, in cell **A6** we have hard-coded the assumption in by typing "1. nb: growth rate does not change over time" into the cell. This text is static, and will not change when the inputs in the model change.

Linked, Dynamic Text

If your assumptions documentation contain numbers, however, which already exist in the model then it is good practice to string text and numbers together in the documentation.

1. Select cell **A7** and enter the hard-coded text "Number of customers starts at 15,065 in 2016"
2. Now make this into a formula by putting an equals sign at the beginning and inverted commas around the text like this: =**"Number of customers starts at 15,065 in 2016"**
3. Replace the value 15,065 by linking it to the value in cell **B5** using the ampersand like this: =**"Number of customers starts at "&B5&" in 2016"**
4. Add in or edit spaces if necessary
5. Next, replace the 2016 with the value in cell **B4** like this =**"Number of customers starts at "&B5&" in "&B4**
6. Test that the dynamic documentation is working by changing one of the values in the cells, for example change the value in cell **B5** from 15,065 to 15,059, and check that your sentence shown in cell **A7** also changes accordingly

We can apply this technique also to our footnoting.

7. Go back to cell **A6** and change your text to a formula so that it looks like this: **="nb: growth rate does not change over time"**
8. We can now dynamically link this to our footnote number in cell **C3**
9. Change the formula in cell **A6** to **=H4&"nb: growth rate does not change over time"**
10. You may choose to add a ". " (dot and then a space) at the beginning of the text part of the formula as shown in the video if you wish so that the result shown in cell **A6 is 1. Nb: growth rate does not change over time"**
11. Test this by changing cell **H4** from a 1 to a 2 and you'll notice the footnote number change as well
12. Because this footnote relates to the growth rate, we think it would be more appropriate to move it closer to the rate shown in cell **B3.** We can easily move the footnote reference by *cutting* and pasting it from cell **H4** to cell **C3** (remember that we need to *cut* and paste, not *copy* and paste in order for the links to work correctly)

In summary, assumptions documentation is absolutely critical in financial modelling best practice. You need to state explicitly where the numbers came from and if there's anything that could be misinterpreted based on your inputs or your assumptions then it needs to be clearly documented. As discussed in this section, there are many different methods and Excel tools that can be used to document the assumptions in your financial model.