Excel Business Modelling

Sample manual - first two chapters

Wise Owl Training

TABLE OF CONTENTS (1 of 5)

TABLE OF CONTENTS (2 of 5)

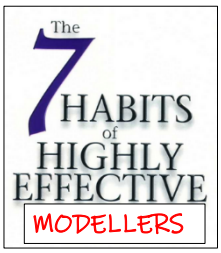
TABLE OF CONTENTS (3 of 5)

TABLE OF CONTENTS (4 of 5)

TABLE OF CONTENTS (5 of 5)

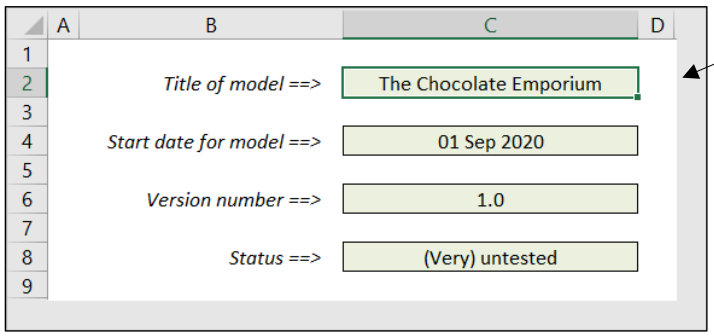
CHAPTER 1 - SEVEN MODELLING GUIDELINES

This chapter lists the seven habits of highly effective modellers (with apologies to Stephen R. Covey).



1.1 Guideline 1 – Use a Cover Sheet

Our first guideline is to include a cover sheet as the first worksheet in any model:



You can hide all of the columns and rows not being used to create a tidier effect.

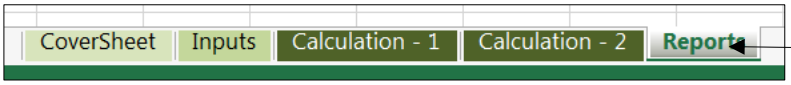
Things this might contain include:

Cover sheet field	Notes
Who wrote the model	Your name and contact details
Revision dates and version number	When the model was created, when it was last revised and any version number
Confidentiality	Whether the model contains confidential data

If your company or organisation has a standard model template which you can use, so much the better!

1.2 Guideline 2 – Separate Inputs and Calculations

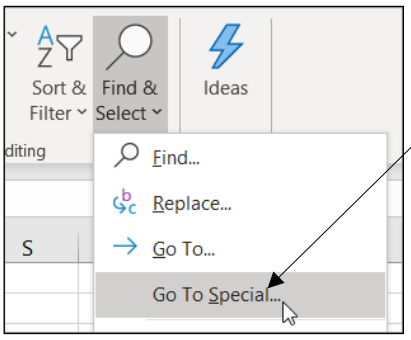
As a fundamental principle, you should put all of your input assumptions on one (or more) separate worksheet(s):



You could use colouring to show the different types of worksheet tab.

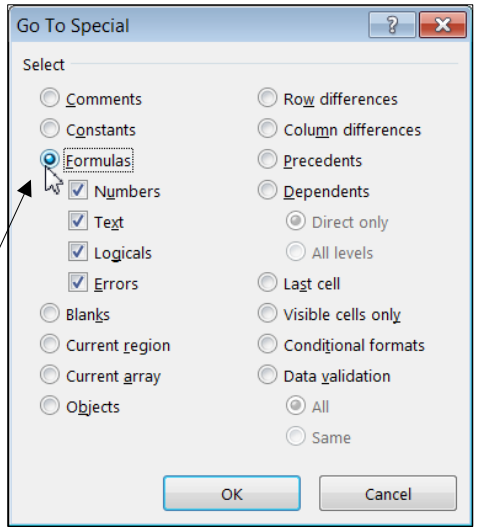
Checking for Rogue Formulae

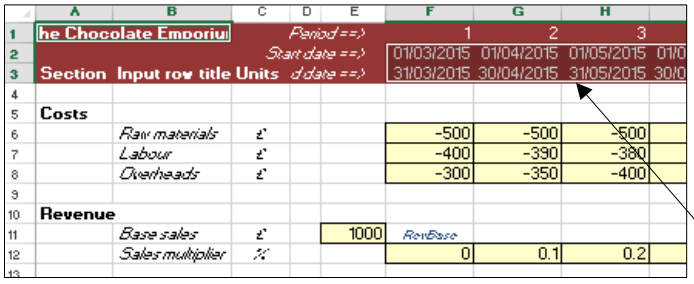
You can highlight any rogue formulae in an input worksheet as follows:



a) Choose this tool from the **HOME** tab of the ribbon (or press F5 and choose the **Special...** button at the bottom left of the dialog box which appears).

b) Choose to highlight formulae.





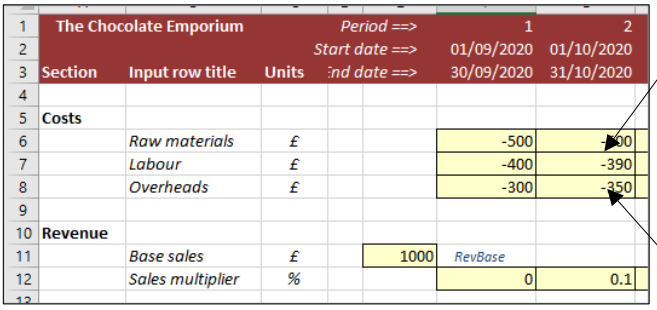
	A	B	C	D	E	F	G	H
1	he Chocolate Emporiu			Period ==>		1	2	3
2				Start date ==>		01/03/2015	01/04/2015	01/05/2015
3	Section	Input row title	Units	d'date ==>		31/03/2015	30/04/2015	31/05/2015
4								
5	Costs							
6		Raw materials	£			-500	-500	-500
7		Labour	£			-400	-390	-380
8		Overheads	£			-300	-350	-400
9								
10	Revenue							
11		Base sales	£		1000	RevBase		
12		Sales multiplier	%			0	0.1	0.2

c) Apart possibly from column headers, as here, no cells should be selected on input sheets.

Another good way to check this is to press Ctrl + ` (this strange symbol, called a backtick, is usually at the top left of your keyboard, above the Tab key) to display formulae. For an inputs worksheet, this shouldn't change any of the displayed values.

1.3 Guideline 3 – Use Styles

Imagine how much easier modelling in your company or organisation would be if everyone used consistent formatting!



	The Chocolate Emporium			Period ==>	1	2
				Start date ==>	01/09/2020	01/10/2020
	Section	Input row title	Units	End date ==>	30/09/2020	31/10/2020
	Costs					
		Raw materials	£		-500	-500
		Labour	£		-400	-390
		Overheads	£		-300	-350
	Revenue					
		Base sales	£	1000	RevBase	
		Sales multiplier	%		0	0.1

This input cell is formatted with the **InputCell** style, which makes it appear with a yellow background and borders …

… which is also why all of these other input cells have the same formatting.

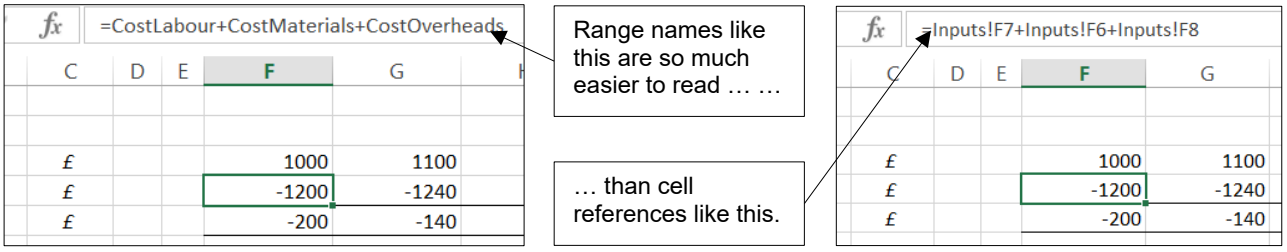
Here is a suggestion for a set of styles that you could create:

Worksheet type	Suggested name	Used for
Inputs	*InputPercent*	Input cells which contain percentages
	InputCurrency	Input cells which contain currency amounts
	InputDate	Input cells which contain dates
	InputOther	Input cells containing text and numbers
Calculations	*CalcPercent*	Calculation cells which contain percentages
	CalcCurrency	Calculation cells which contain currency amounts
	CalcDate	Calculation cells which contain dates
	CalcOther	Calculation cells containing text and numbers
Reports	*RepPercent*	Report cells which contain percentages
	RepCurrency	Report cells which contain currency amounts
	RepDate	Report cells which contain dates
	RepOther	Report cells containing text and numbers
General	*GenRangeName*	How range names appear to the right of each row
	GenUnits	How units appear
	GenTitle	Titles for blocks of data
	GenItem	Individual item lines in a report

It doesn't matter whether your input cells are blue, pink or red with yellow spots, just as long as they are consistent.

1.4 Guideline 4 – Use Range Names

A *range name* is a name given to a cell (or to a block of cells), which you can then use in your formulae. Range names make formulae easier to read, write, maintain and test!



You should aim to avoid using any references at all in your models (although there will be a few times when you have to relax this slightly).

1.5 Guideline 5 – Keep Formulae Simple

Here is a sequence of formulae which display a message saying how many spaces there are in a worksheet name (this is a daft thing to do, but that's not the point!).

A series of formula to display a message like this in the final cell:

List of calcs has 2 space(s)	*Message*

=CELL("filename")	*FileName*
=FIND("]",FileName)+1	*SheetStarts*
=RIGHT(FileName,LEN(FileName)-SheetStarts+1)	*SheetName*
=SUBSTITUTE(SheetName," ","")	*WithoutSpaces*
=LEN(SheetName)-LEN(WithoutSpaces)	*NumberSpaces*
=SheetName & " has " & NumberSpaces & " space(s)"	*Message*

Here's the same thing done in a single formula – probably!

```
=RIGHT(CELL("filename"),LEN(CELL("filename"))-FIND("]",FileName)+1) & " has "
& (LEN(RIGHT(CELL("filename"),LEN(CELL("filename"))-FIND("]",FileName)+1+1))-
LEN(SUBSTITUTE(RIGHT(CELL("filename"),LEN(CELL("filename"))-
FIND("]",CELL("filename"))+1+1)," ","")))  & " space(s)"
```

Our guideline will be to keep formulae short and simple (if necessary breaking them up into several steps).

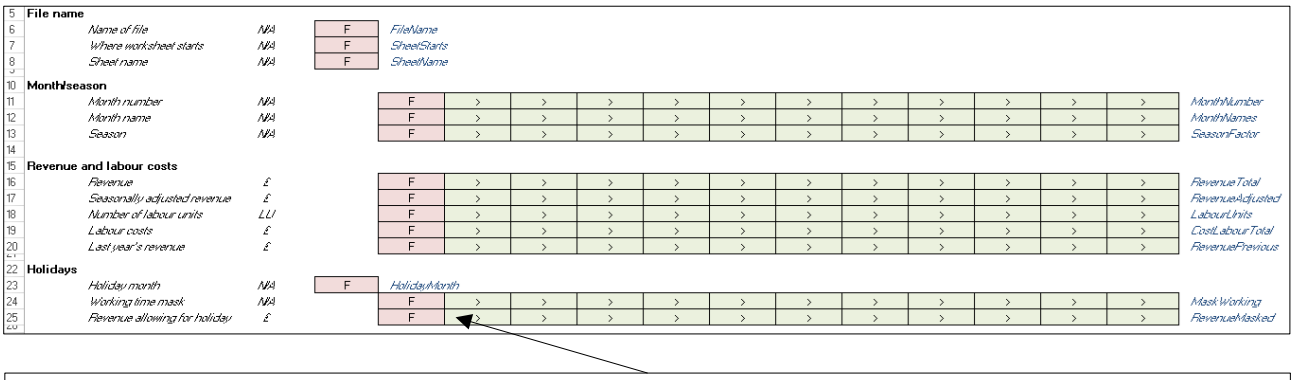
If you prefer the single long formula above, you're not going to like your Wise Owl Excel course!

1.6 Guideline 6 – Copy Formulae Across

Imagine a software application which colours Excel cells using these rules (such programs do exist – for example, *Spreadsheet Detective* and *Operis Analysis Kit*, or *OAK*):

Contents of cell	What Excel would do
Unique formula	Colour the cell pink and put an **F** in the cell
Copied from its neighbour	Colour the cell green and put a **>** in the cell

Such a program would produce a map like this for our model:

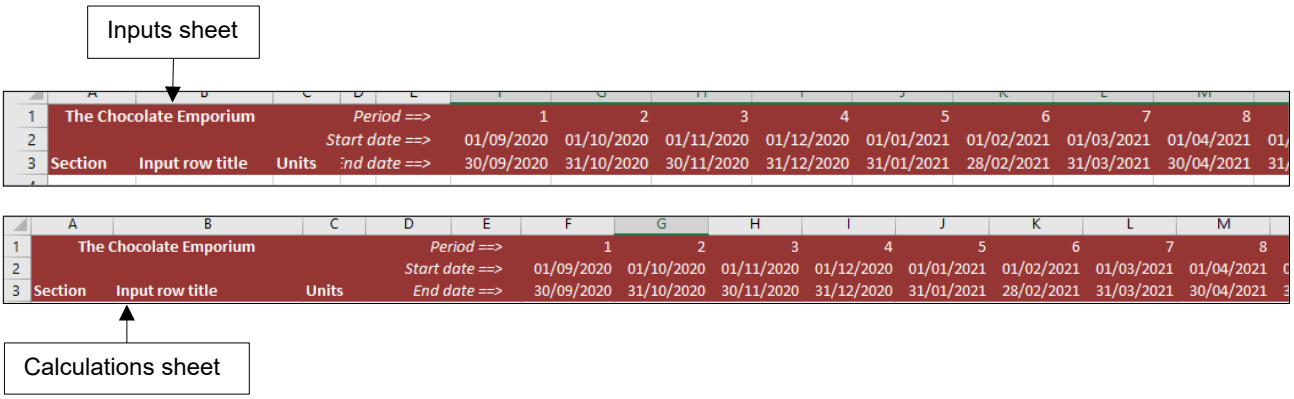


In a well-written model, you'd see a map with **F**s in the first column and chevrons in subsequent columns showing where the formulae had been copied over.

Our guideline will be to ensure that unique formulae only appear in the first column of any row, making the resulting spreadsheet easier to maintain and test.

1.7 Guideline 7 – Use Consistent Period Headings

It is good practice to ensure that each of the worksheets of your model uses the same time period headings beginning in the same columns:



To do this, break your columns down into the smallest required level of granularity (for the example above this is by month).

CHAPTER 2 - RANGE NAMES

2.1 What are Range Names?

You can assign *names* to individual cells, or to blocks of cells:

4									
5	**Costs**								
6		*Raw materials*	£		-500	-500	-500	-500	-500
7		*Labour*	£		-400	-390	-380	-300	-290
8		*Overheads*	£		-300	-350	-400	-800	-850
9									
10	**Revenue**								
11		*Base sales*	£	1000	*RevBase*				
12		*Sales multiplier*	%		0	0.1	0.2	1	1.1

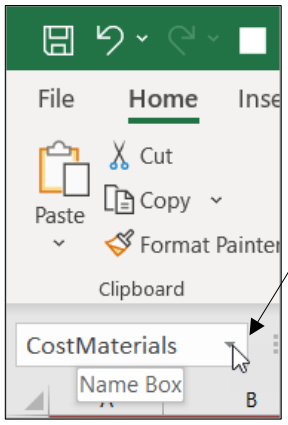
For example, you could call this single cell a name like **RevBase** ...

... and this block of cells a name like **CostMaterials**.

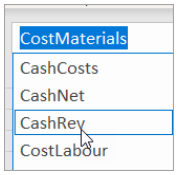
The key to using Excel effectively is to gain a thorough understanding of what range names are and how you can use them in your formulae.

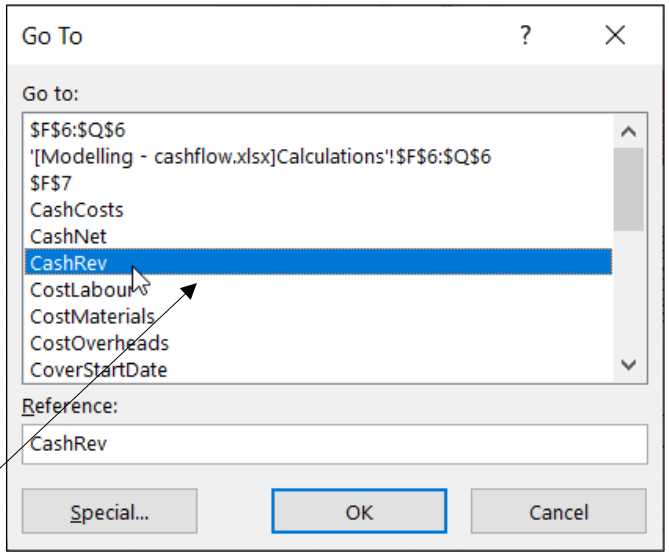
Going to a Range Name

One of the many benefits of range names is that they allow you to find a cell (or block of cells) quickly:



You can click on this arrow to the right of the **Name Box**, and choose which range you want to go to (it doesn't have to be on the same worksheet):





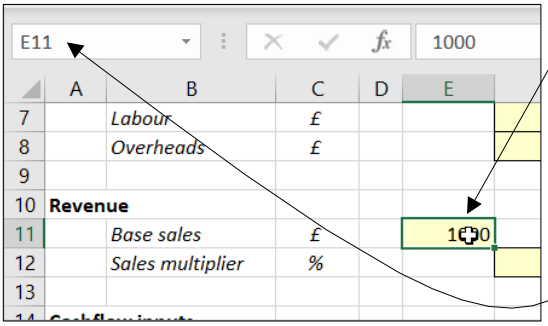
Alternatively, press the F5 function key to go to a range, then double-click on it in the list (or select it and choose OK).

2.2 Creating Range Names

There are (at least) three ways to create a range name in Excel – the best one is probably the last!

Method 1 – Using the Name Box

To create a range name for a cell or block of cells using the **Name Box**:



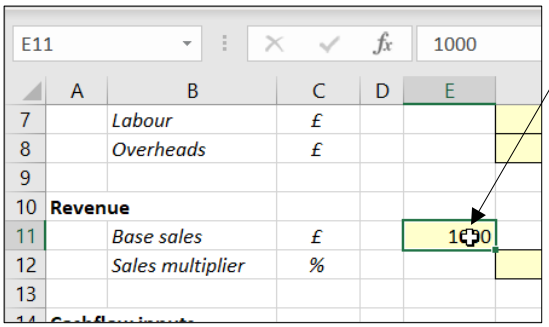
a) Select the cell or cells to which you want to attach a name.

b) Click in the name box, and type in the name you want to use (you can use underscores, but can't use spaces):

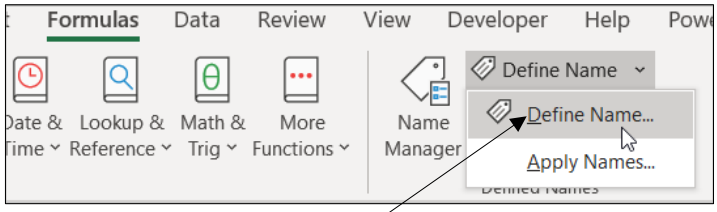
You must then press ↵ to confirm the range name.

Method 2 – Defining Names

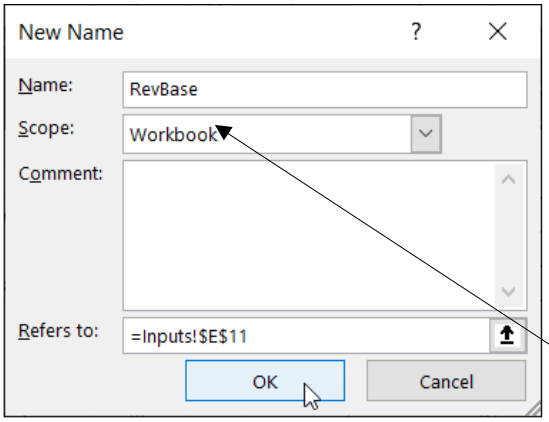
Another (harder) way to create a range name is using the ribbon:



a) As for the first method, first select the cell or cells you want to name.



b) Choose to define a range name on the **Formulas** tab of the ribbon.



c) Type in a name for your range (again, no spaces please) and select OK (the best thing to do is to leave the scope as **Workbook** – scope is explained later in this chapter).

Method 3 - Creating Range Names from Selected Cells

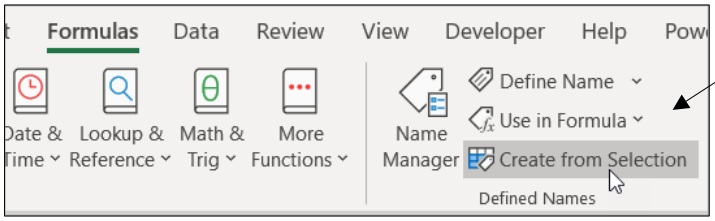
This is the best way to create range names, partly because it lets you assign names to lots of blocks of cells at the same time.

Another advantage of this method is that you can see which names refer to which blocks of cells, but be aware that this is not dynamic (if you change the range name typed in next to a block of cells, this won't have any affect on the existing range name applied to them).

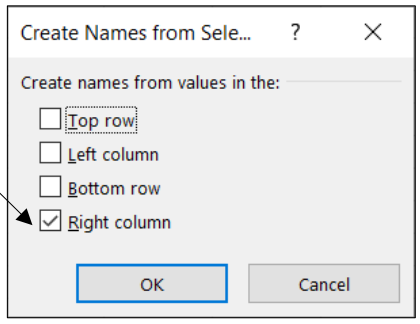
Here's how to use this method:

a) Select a block of cells which includes the names that you want to use and the cells that you want to name.

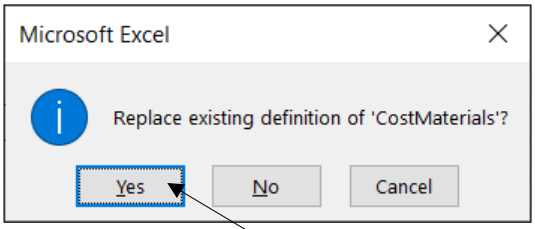
	A	B	C	D	E	F	G	P	Q	R
1	**The Chocolate Emporium**			*Period ==>*		1	2	11	12	*PeriodIn*
2				*Start date ==>*		01/09/2020	01/10/2020	01/07/2021	01/08/2021	*StartDateIn*
3	**Sectio**	**Input row title**	**Units**	*End date ==>*		30/09/2020	31/10/2020	31/07/2021	31/08/2021	*EndDateIn*
4										
5	**Costs**									
6		*Raw materials*	£			-500	-500	-500	-500	*CostMaterials*
7		*Labour*	£			-400	-390	-300	-290	*CostLabour*
8		*Overheads*	£			-300	-350	-800	-850	*CostOverheads*
9										
10	**Revenue**									
11		*Base sales*	£		1000					
12		*Sales multiplier*	%			0	0.1	1	1.1	*RevMultiplier*
13										



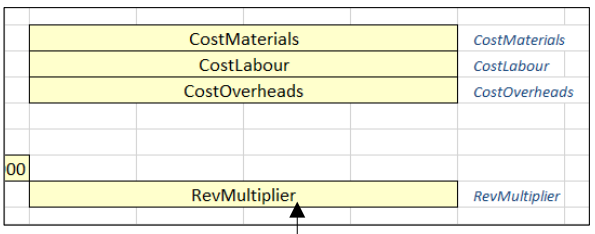
b) Choose this option on the **Formulas** tab of the ribbon (or you can do the same thing by pressing Ctrl + Shift + F3).



c) Excel often (but not always) guesses correctly what you want to do. On this occasion we do want to create range names using labels in the right-hand column, so select OK.



d) If you already have one or more ranges with these names, you will be prompted whether you want to override them.



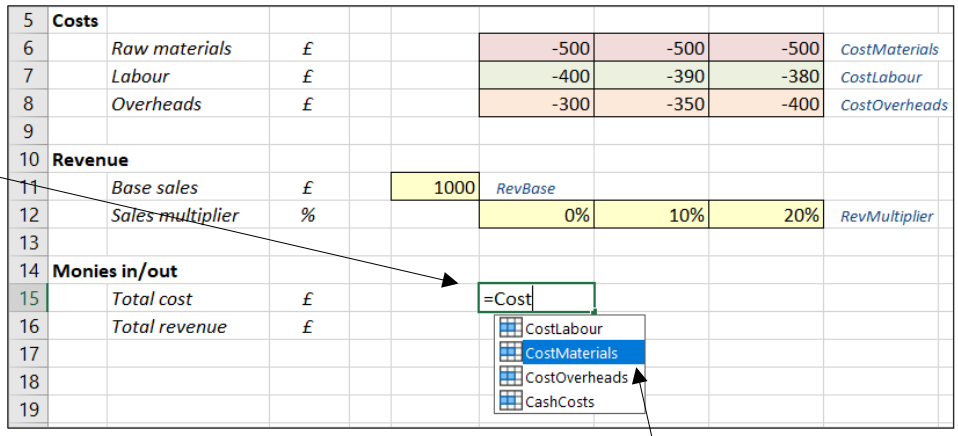
e) Excel creates these four range names for this example (the blank cells/rows are ignored).

2.3 Range Names in Formulae

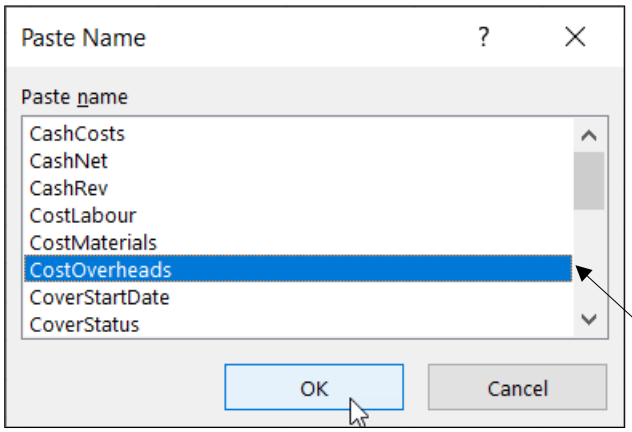
Referencing Range Names in Formulae

For the following example, suppose we want the total cost to be the sum of the three ranges called **CostMaterials**, **CostLabour** and **CostOverheads**. Here's how to create this formula:

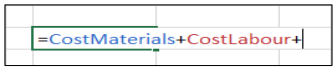
a) Start typing in a formula, and begin typing the first range name that you want to reference. Press the Tab key to get this:



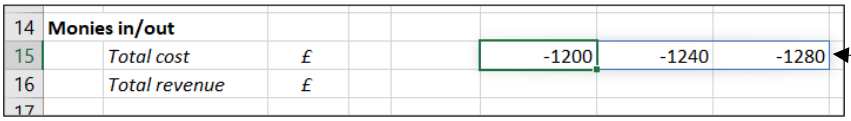
b) Type in a + sign, then type in the start of the next range name and again press Tab.



c) For the third range name, as an alternative you could press F3 to bring up a dialog box listing the range names in your workbook in alphabetical order:



d) Double-click on the final range name to complete your formula.

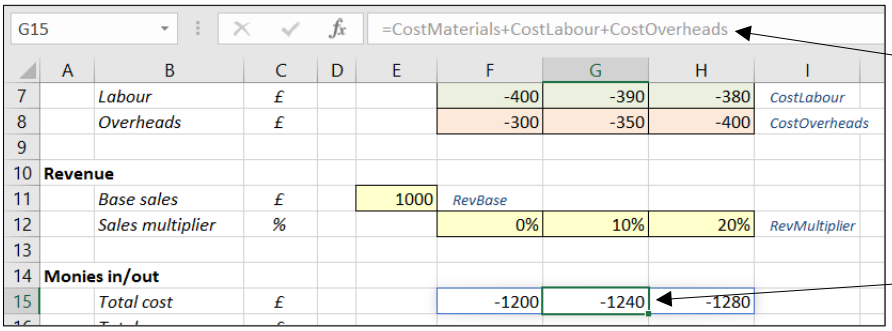


e) The formula fills cells corresponding to the widths of the referenced ranges.

*Once you've clicked in the list of range names, you can type the first letter of a range name repeatedly to cycle to it (so for the above example you could press C six times to go to the 6th range name beginning with a **C**).*

Dealing with Spill Errors

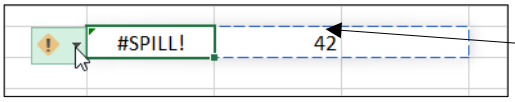
The formula we've created only exists in the left-hand cell, but it uses a new Excel feature called *dynamic arrays* to fill multiple cells:



The formula shows up in light grey in the formula bar if you click on ...

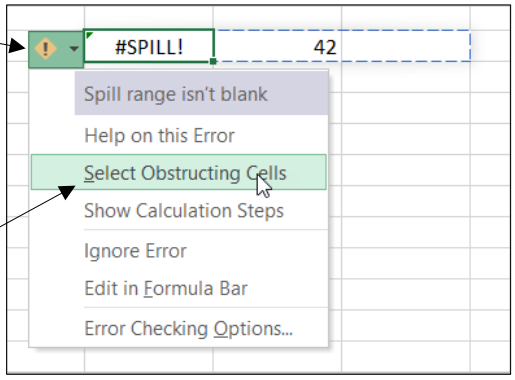
... any cell apart from the left-hand one in your row.

If there's something in the way Excel can't create the formula and shows a spill error:

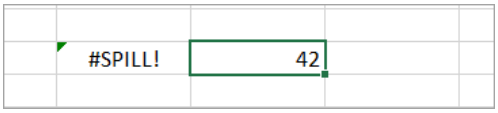


a) Here someone has typed 42 into the second cell, preventing the formula from spanning its full width.

b) You can click on the floatie to see what the error is.



b) It's as we thought: the spill range isn't blank. The best thing to do would be to select (and then delete the contents of) the obstructing cells:



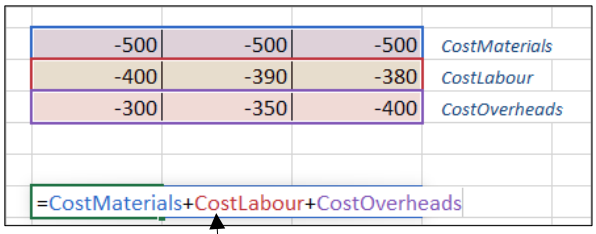
The Possible Spill Errors

You can get a **#SPILL!** error in Excel when one of the following happens:

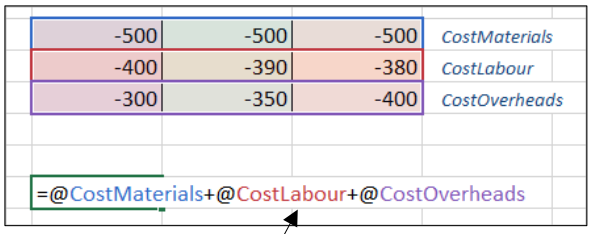
Error	How to solve
The spill range isn't blank	Remove the obstructing cell contents (as above)
Indeterminate size	Don't use functions like **=RAND** or **=RANDBETWEEN** with dynamic arrays
Extends beyond worksheet edge	Use a smaller range/array
Table formula	Spilled array formulae are not supported in tables
Out of memory	Try referencing a smaller array or range
Spill into merged cells	Un-merge the cells
Unrecognized / Fallback	Check your formula for errors!

Implicit Intersection using @

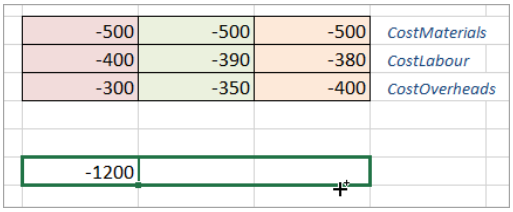
You can prefix range names with the @ character to tell Excel not to use dynamic arrays:



This example uses dynamic arrays: the formula entered fills all 3 cells.



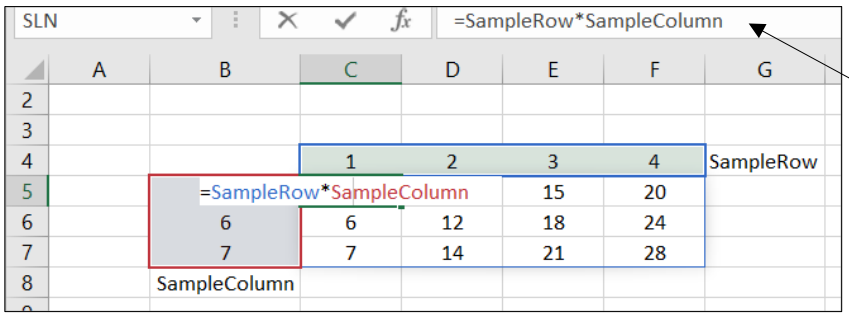
This example doesn't use dynamic arrays: the formula entered only fills the left-hand cell, and you would have to copy it across to the other two cells:



When you open a workbook created in an older version of Excel, Microsoft will add @ prefixes before range names in formulae to show that you are not using dynamic ranges (you couldn't have been; they didn't exist in earlier versions).

Two-Dimensional Range Formulae

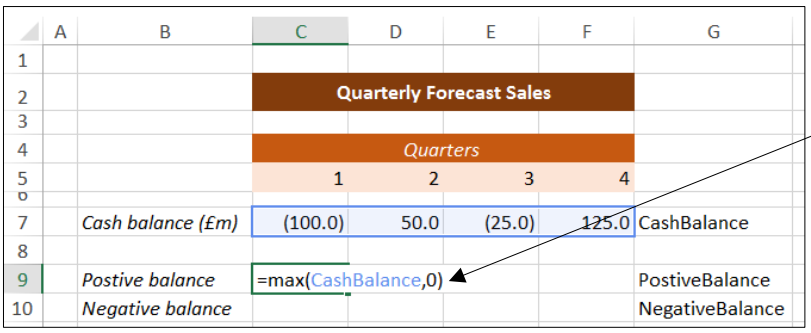
You can create a matrix of results by creating formulae combining ranges of different shapes:



Here the formula multiplies the value in the green range (**SampleRow**) for the column in question by the value in the blue range (**SampleColumn**) for the row in question.

Getting Aggregation Functions to Work using +

Some common statistical functions (think **SUM**, **MAX**, **MIN**, **AVERAGE**, **COUNT**) work on a whole range, whereas we want them to work sometimes on a cell-by-cell basis:

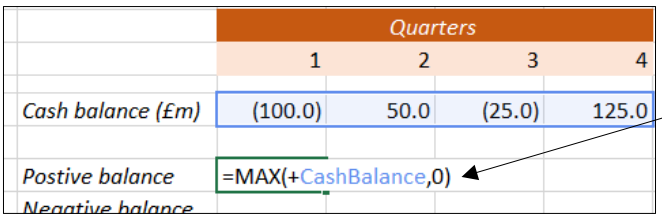


	A	B	C	D	E	F	G
1							
2			Quarterly Forecast Sales				
3							
4			Quarters				
5			1	2	3	4	
7		*Cash balance (£m)*	(100.0)	50.0	(25.0)	125.0	CashBalance
8							
9		*Postive balance*	=max(CashBalance,0)				PostiveBalance
10		*Negative balance*					NegativeBalance

Without any modification this formula will give us 125 in each cell, since this is the highest value out of -100, 50, -25, 125 and 0!

Cash balance (£m)	(100.0)	50.0	(25.0)	125.0
Postive balance	125.0	125.0	125.0	125.0

To get this formula to give the positive balance for each quarter, precede the range name by a **+**:



	Quarters			
	1	2	3	4
Cash balance (£m)	(100.0)	50.0	(25.0)	125.0
Postive balance	=MAX(+CashBalance,0)			
Negative balance				

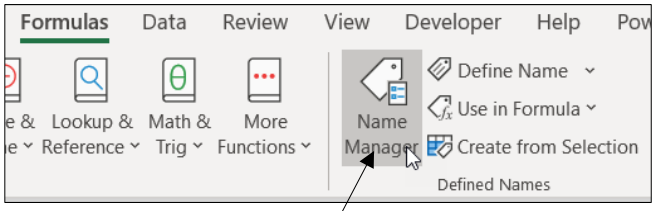
It's amazing how much difference a single plus sign can make in a formula. This would give:

Cash balance (£m)	(100.0)	50.0	(25.0)	125.0
Postive balance	0.0	50.0	0.0	125.0

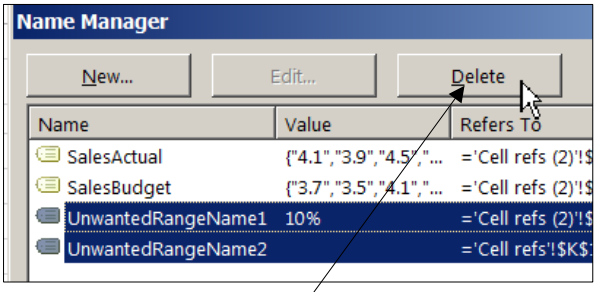
2.4 Working with Range Names

Editing and Deleting Range Names

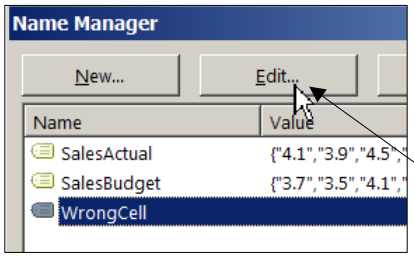
Range names are harder to edit/delete than they are to create!



Press Ctrl + F3 or click on this tool on the **Formulas** tab of the ribbon to bring up the **Name Manager** in Excel.



To delete ranges, select them (using the Ctrl key if more than one) and click on Delete .



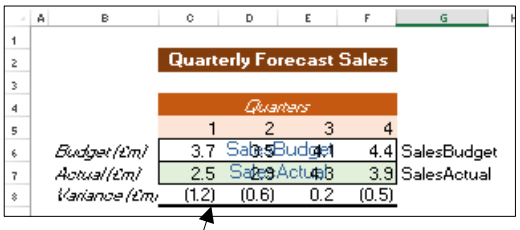
To edit a range name (whether to change its name, or to change the cells that it points to) select the range name in the list and click on the Edit... button.

*Because editing range names to point to different cells is a pain (and in particular, because it can't be done using the **Name Box**), by far the easiest way to change the cells that range names point to is by using the **Create from Selection** facility shown earlier in this chapter..*

Viewing Range Names

A bizarre feature of Excel is that if you zoom in to a tiny view (generally anything less than 40% will do) you can see range names superimposed:

If you use this slider at the bottom right corner of Excel to zoom in to a number less than 40% …



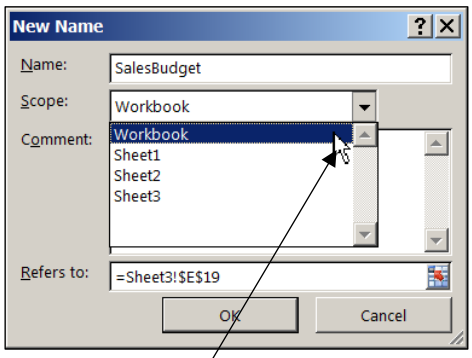
… you can see range names superimposed on the cells to which they apply (but it's useless, because the font is too small to read!).

2.5 The Scope of Range Names

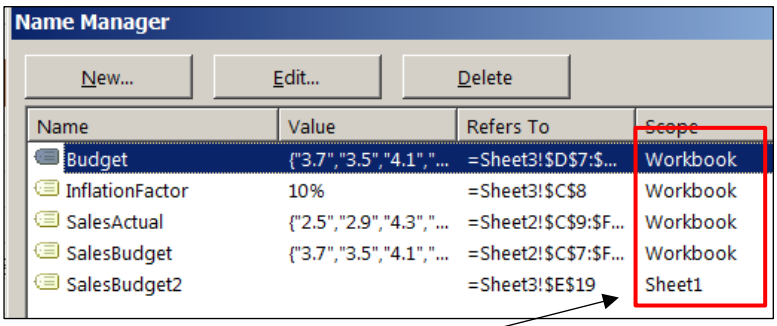
The *scope* of a range name controls where you can use it. Range names can be scoped to an entire workbook, or to a specific worksheet within it.

Choosing the Scope of a Range Name

You can only choose the scope of a range name when you create it, and then only if you use the **Define Name** method (range names created by other methods always have workbook scope).



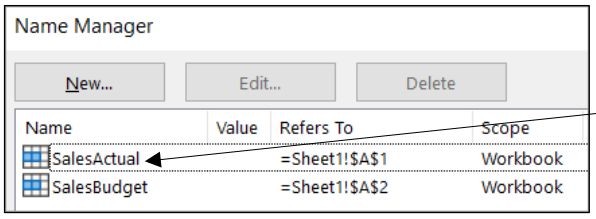
You can choose the scope of a range name when creating it by clicking on this drop list.



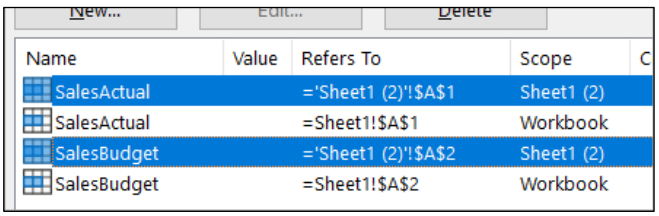
You can use **Name Manager** to view range name scopes, as here. You can refer to names scoped to a workbook from any worksheet, but names scoped to a specific worksheet can only be used in that worksheet.

Copying Worksheets Copies their Range Names with Local Scope

When you copy a worksheet, you create copies of all of its range names:



Suppose you have a worksheet called **Sheet1** which contains two range names as shown, and you then take a copy of this worksheet:



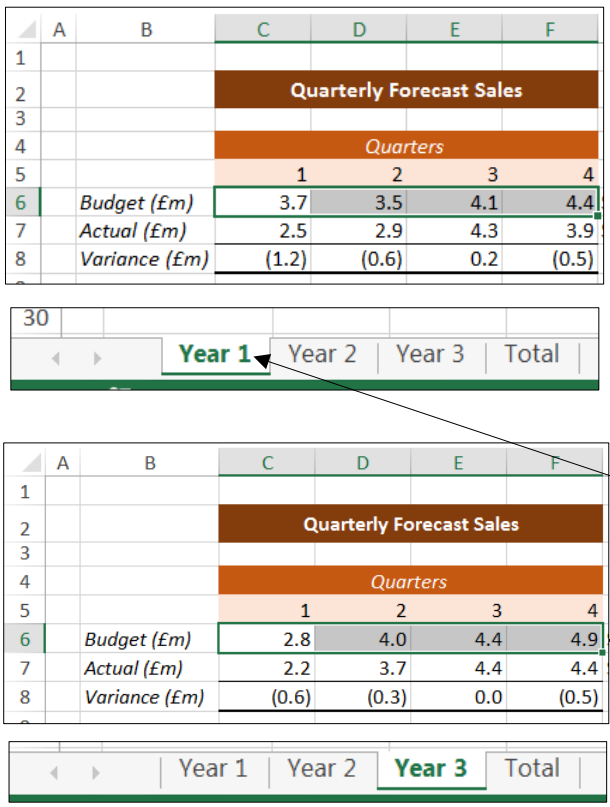
Excel will create one local copy of each range name – for example:

Range name	Scope
SalesActual	Workbook
SalesActual	Local to the new copied sheet

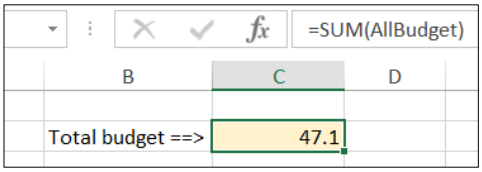
This can be very confusing! The best strategy may be to carefully rename unwanted local copies of range names immediately after you copy any worksheets.

2.6 3-Dimensional Ranges

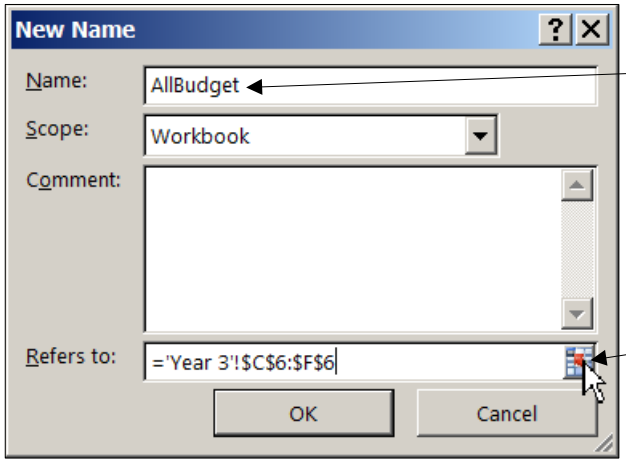
To impress friends you can create *3-dimensional* range names:



Suppose that you want to create a single range name called **AllBudget** which includes cells **C6**:**F6** on worksheets **Year 1**, **Year 2** and **Year 3**, such that the following formula would work:

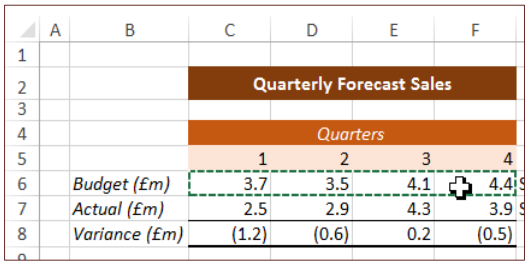


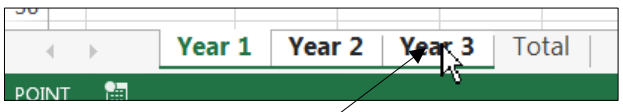
To do this, follow these steps:



a) On the **FORMULA** tab of the ribbon, choose Define Name to create a new range name and type in a name.

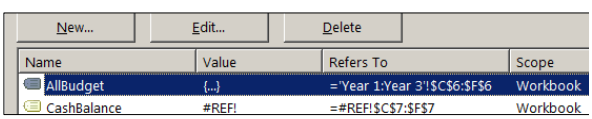
b) Click here to select a range of cells, and select the block of cells on the first worksheet (here **Year 1**):





c) Hold down the Shift key and click on the last worksheet for the range name, then press OK twice.

d) The result is a range name for a 3D block of cells!

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What we do!

		Basic training	Advanced training	Systems / consultancy
Office	Microsoft Excel			
	VBA macros			
	Office Scripts			
	Microsoft Access			
Power BI, etc	Power BI and DAX			
	Power Apps			
	Power Automate (both)			
SQL Server	SQL			
	Reporting Services			
	Report Builder			
	Integration Services			
	Analysis Services			
Coding	Visual C#			
	VB programming			
	MySQL			
	Python			


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