

# MODEL PERFECT

## DANIEL FREEMAN REVEALS THE 10 GOLDEN RULES FOR LICKING YOUR SPREADSHEETS INTO SHAPE



Spreadsheets are used by accountants and others to prepare business-critical analysis and valuations, often driving transactions worth millions of pounds. Yet although such spreadsheet-based financial models have now been around for many years, a lot of spreadsheets could be described as being ‘unfit for purpose’ with high error rates. Below are some simple, practical techniques to help minimise the risk of introducing or failing to detect errors in financial models.

### Golden rule 1 – Write a specification

The specification is a written description of what the model should do. It serves two important purposes: firstly, it forces you to think about important model design issues *before* you start developing the model; and secondly you can use it to get stakeholders to buy into the model. Although it doesn’t have to be very detailed – a lot of the detailed calculation logic can be developed when building the model – it does need to address important issues such as the objective of the model, its key outputs and deliverables and overall structure. Upfront you should decide about the time periodicity of the model – whether it’s monthly, quarterly, semi-annual or annual – and whether you want to be able to update the model for actuals.

### Golden rule 2 – Use a single formula that can be copied across a row or block

A formula should be written in such a way that it can be copied across a row or block without having to make any changes to it. A formula that is not simply a copy of the

formula in the cell to the left or the cell above is known as a ‘unique’ formula. Writing models in this way reduces the likelihood of errors occurring and makes reviewing models easier, quicker and cheaper.

### Golden rule 3 – Be consistent in your use of columns

The same column on different sheets (that have the same time periodicity) should represent the same time period and each sheet should only have one time periodicity (eg, annual and monthly calculations should not be on the same sheet).

### Golden rule 4 – Use informative labels and be explicit about units

Each line item should have a text label that provides an adequate description for that row and an explicit unit that goes with it. I recommend using a dedicated column for the units. Labels can be made more dynamic – this means that the label isn’t just text that has been typed in but rather links to an input cell so that if the description changes it will be updated automatically throughout the model (see example below):

### EXAMPLE: USING THE ‘&’ CHARACTER TO CREATE A DYNAMIC LABEL

If cell A5 contains the text “Type1”  
Then we can create a dynamic label in cell B5 by making the formula =A5&“- Sales”  
The result in Cell B5 is “Type1-Sales”

**Golden rule 5 – Clearly identify inputs and collect them together**

Except in the simplest models, inputs, intermediate calculations and outputs should be separated from each other (normally on separate sheets).

Inputs should be clearly identified – a lot of modellers use a box with a pale yellow cell background colour. Don't hardcode or embed an input within a formula as this makes them harder to find and update. Instead set them up as explicit inputs and refer to these cells within formulae.

**Golden rule 6 – Use flags for frequently used 'events'**

Flags are just intermediate calculations that tell us when an event (or events) has occurred. They are typically binary in nature ie, 1 if the event has occurred, 0 if it hasn't. We use them to make our calculations more transparent and if we find ourselves using the same event more than once. They are also an essential element in building formulae that can be copied across a row or block.

**Golden rule 7 – Keep it simple**

It's easier said than done but here are some tips for keeping things simple:

- don't duplicate inputs;
- don't repeat calculations unless really necessary;
- do make each calculation as easy as possible to review by putting all inputs close by – 'import' the results of previous calculations by creating a lookup row that simply links to the results of previous calculations without performing any operations on it;
- do split out complex calculations across rows;
- do have a logical progression. We tend to like to read from left to right and from top to bottom. You'd be surprised at how many times spreadsheet calculations don't follow this;
- do separate out calculations on to different worksheets in the model, ie, have one for tax, one for working capital, one for depreciation, etc;
- don't feel like you need to use all of the Excel formulae – there are probably 35-40 key formulae that most financial modellers use.

**Golden rule 8 – Avoid circular references**

A circular reference is a formula that references itself. The problems with circular references are firstly, once you create one you can accidentally create others you won't notice and secondly, having a circular reference means that there may be multiple, non-unique solutions to your model. You should always remove a circular reference when first created as otherwise it can be almost impossible to find and correct on bigger models. Also, you should save your work regularly so you can always go back to a previous version that hasn't got the circular (if all else fails).

**EXAMPLE: CREATING A FLAG**

Assume we have an asset class (say computers) that are depreciated over three years. Every three years starting from 2009 a new computer is purchased.

We want to create a formula that returns the value of zero except in the year in which the new computer is purchased when the formula needs to return a 1.

We can then use this flag, along with an assumed cost of a new computer, to generate the fixed asset additions in each year.

Assume input cells:

C7: 2009

C8: 3

C9: 1000

and the time series header row runs from G4 to M4 and contains the values 2006 up to 2012  
G12 "=IF(AND(G\$4>=\$C\$7,MOD(G4-\$C\$7,3)=0),1,0)"

This formula can be copied across the remainder of the row into cells H12 to M12

G14: "=G12\*\$C\$9"; copy across rest of row to cell M14

	A	B	C	D	E	F	G	H	I	J	K	L	M
1													
2													
3													
4	Header row						2006	2007	2008	2009	2010	2011	2012
5													
6	INPUTS												
7	First Year capex replaced	yyyy	2009										
8	Replacement cycle	#yrs	3										
9	Cost of new computer	£	1000										
10	CALCULATIONS												
11													
12	Flag: 1 if capex replacement	1 or 0					0	0	0	1	0	0	1
13													
14	Capex: Additions - Computer	£					0	0	0	1000	0	0	1000

A lot of spreadsheets could be described as being 'unfit for purpose' with high error rates

**Golden rule 9 – Keep regular backups/ version control/ log of changes**

Don't save a new version of your spreadsheet by overwriting the previous version. This makes it impossible to go back to older versions of the model, which could be a disaster if the file becomes corrupted. You should also keep an archive copy of any model versions that you send to other people or that are used for board reports so that you can go back to them. You should keep a proper log of the changes that you make to the model and track the impact on certain key variables/outputs. This enables you to quickly reconcile the current version of the model back to previous versions. Without this log and version control, confidence in the model outputs can be shaken.

**Golden rule 10 – Get the model reviewed**

The model build process should not be a one-person task. It is important to build in time to test the model, review and sense-check model outputs before relying upon them. This testing and review should ideally be conducted by someone other than the modeller. In order to make the review as effective as possible, non-financial or related operational information should also be provided to the reviewer because, for example, it is hard to sense-check whether revenues look right unless you understand the underlying assumptions made about sales quantities and prices.

Daniel Freeman ACA is founder of specialist consultancy [Financialmodelling.com](http://Financialmodelling.com).  
[www.financialmodelling.com](http://www.financialmodelling.com)