

Fresh fields

Building a reliable and thorough spreadsheet-based model needn't be a painful process – as long as you stick to basic principles. **Stephen Aldridge** offers his step-by-step guide to better financial modelling

Beyond a simple discounted cash flow analysis, most accountants won't have had sufficient training to build spreadsheet models that can be applied to the complex business decisions managers regularly face. Many studies on the subject have concluded that serious errors exist in an alarming proportion of such models.

Most tend to evolve with very little advance planning, so it's worth working out beforehand exactly what you want to achieve with yours. This should include establishing the objectives of the model – for instance, will you use it to support a loan application, to decide between mutually exclusive options etc? What will you (or the bank) require as outputs to be able to make the decision?

Having worked out what you want from the model, you need to consider what should be driving it – ie, the inputs. It seems obvious that they should relate to the key drivers of the business, but too many models glibly assume that profit will grow year on year by a healthy percentage, with no supporting evidence or calculations.

You should also decide on the level of detail of the data and the calculations. For example, should you use monthly or annual time periods? Will simplified tax treatment suffice, or should you calculate the written-down allowances for a more thorough tax treatment? A common reason for building a model is to test the sensitivity of a business case to uncertainty

about key drivers, so give some thought to the flexibility required.

It is rare to find a model that has clearly documented objectives and assumptions, but these should not be seen as optional. You will have to make many assumptions when developing your model, and its users will have greater confidence in it if the assumptions are stated explicitly. Another good reason for documenting your assumptions is that it forces you to focus on the validity of the inputs – the adage “garbage in, garbage out” applies as much here as it does anywhere.

All but the simplest models will have multiple worksheets and calculations. To help users understand the model, it's worth sketching out its modules and how they interact with each other. Better still, if you put this schematic diagram on the front sheet of your model with hyperlinks to the relevant modules, it becomes a navigational aid, helping users to find their way around (*see diagram, opposite page*).

Although there are many techniques you can use to improve your model-building, most leading modellers broadly agree on the key principles that should be followed:

- **Integration.** A model that has interlinked profit and loss, cash flow and balance sheet has a built-in check of its own integrity.
- **Separation.** Keep the inputs separate from calculations and outputs. This has the advantage of clearly identifying the cells

that drive the calculations, and it prevents the accidental corruption of calculations.

- **Copy formulas across an entire row.** Formulas constructed this way are easier to maintain and review, because only one formula per row needs to be altered or checked. For a quarterly loan repayment, for example, use an “if, then” construct so that payments are made in the correct periods.
 - **Maintain consistency between sheets.** The same time period should be in the same column in all sheets. This avoids accidental references to the wrong period.
 - **Keep to a sign convention.** Most modellers favour keeping income and assets positive, and expenses and liabilities negative.
 - **Maintain a logical flow.** A model that flows logically from left to right and from top to bottom, with a documented set of modules, can be understood by users and reviewers, and is more easily adapted. A good test is whether the logic can be followed on a printed version of the calculations.
 - **Avoid circular references.** These can behave in unexpected ways and, once one is introduced (maybe deliberately), it's possible to introduce other circular references without the usual warning.
 - **Don't use balancing figures or “hard-coded numbers” – ie, numbers instead of cell references – in the formulas.** To ensure that your balance sheet stays in balance and to provide an integrity check, you should calculate all of the lines in the balance sheet and then check that it does balance. Resist the temptation to put a “fix” into a formula. If the balance sheet doesn't balance, find the problem and solve it.
- Double-entry bookkeeping has survived as the basis for all accounting because of the rigour it imposes. You can adopt a similar approach to building financial models. The following simple method, when used in an integrated financial model, will allow you to produce a balancing balance sheet, instilling confidence in it among users.
- For each element of your model you will need to deal with the implications for profit and loss, cash flow and balance sheet. You can make this easy with a series of four-line or five-line schedules that will form the heart of the integrated model. This calculates the opening and closing balance of an “account” and the movements in and out.
- Taking a debtor account, for example, the schedule on the opposite page provides the values needed to ensure that an integrated model can be produced. You need one of these schedules for every category of asset, debtor, creditor and all other balance-sheet entries. The general technique can be used for many

other calculations – for instance, working out the written-down value of an asset or the outstanding balance, interest and repayments for a loan. The basic approach can be extended to handle rolled-up interest, fees and so on. Visit www.financialmodelling.net for examples.

To ensure that you end up with a balancing balance sheet, build the most basic of balance sheets at the start and populate it, profit and loss and cash flow each time you create a new calculation. That way, you will check the integrity of your calculations at every step. Many errors can then be spotted immediately, because the balance sheet will no longer balance, but note that a balancing balance sheet cannot be taken as proof that there are no errors.

The review and test phase of financial modelling is often overlooked or done poorly. You wouldn't expect to buy software that hasn't been through the rigours of alpha and beta testing before going on sale, but many spreadsheet models receive little more than a cursory inspection.

The level of testing that you apply should depend on the purpose of the model and the risk associated with errors. If you are basing multi-million-pound decisions on the model,

SAMPLE SCHEDULE FOR DEBTOR ACCOUNT

	Period 1	Period 2	Financial report affected
Opening balance	25	23	
Additions	6	7	Profit and loss
Payments	-8	-6	Actual cash flow in period*
Closing balance	23	24	Balance sheet
Working capital movement	2	-1	Used in cash flow statement*

*Cash flow for a model can be calculated by the direct method, using the actual cash flows (common in project finance models), or the indirect method, producing a reconciliation of operating profit to operating cash flow (preferred for FRS1 cash flow statements).

obviously it should be tested exhaustively. If you are borrowing on the strength of the model, the lender is likely to insist on a full independent review. But if it's for an internal departmental budget, testing could justifiably be less extensive.

There is software available that's designed to help in the review process, but there's no substitute for checking both the numerical and formulaic content of the model. To achieve the highest level of comfort, an independent and experienced modeller should check each unique formula in the model. This may not be as onerous as it sounds: a well-

constructed model will contain only a small percentage of formulas that are not copied across or down. As a minimum, check that formulas are copied across rows correctly and perform some "sense-checking" of the numerical output of the model. Varying input values and observing the impact on outputs is also a useful technique for spotting errors.

As with all specialist areas, you can't become an expert overnight, but your models will be better if you follow these principles. FM

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SCHEMATIC DIAGRAM OF A TYPICAL FINANCIAL MODEL

