

## Advances in spreadsheet modelling Managing the risk

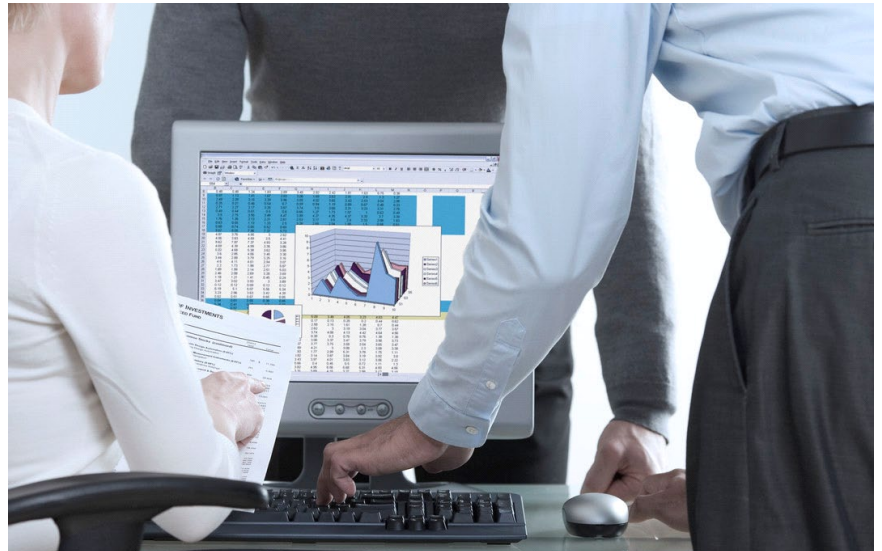
The use of spreadsheet applications for financial modelling is now second nature to most in the industry. With technological advances in software and hardware the temptation may be to extend and increase the complexity of the spreadsheet modelling to take advantage of the innovation. However, with this greater spreadsheet power comes greater potential risk. This article discusses the trade-off between the flexibility of spreadsheet modelling and the increased risk and lack of audit which could occur when overextending spreadsheet models.

### Acceptance of spreadsheet modelling

Today, spreadsheets are used extensively for mathematical and financial modelling in a wide variety of sectors. The prevalence of spreadsheets can be attributed to ease of use, calculation capabilities, data manipulation and visualisation tools, and the growing familiarity with the spreadsheet within the office productivity suite environment.

Some of the advantages of using spreadsheets in financial modelling are:

- spreadsheets are commonly used, easy to share and a large knowledge-base has been established;
- the size of spreadsheets and the number of cells and sheets in a workbook has increased significantly since the first spreadsheets became available. This allows larger and more complex models to be developed. For example, Microsoft® Excel 2007 has 1000 times more cells per worksheet than Excel 2003;
- the use of macros and other programming languages in spreadsheets encourages custom development work. This is a powerful feature that allows complex situations to be modelled;
- spreadsheets contain numerous data visualisation and manipulation methods providing a quick means to preparing management information and graphical reports; and



- data transfer and integration of applications has greatly improved. Spreadsheets now offer integration with other products in office productivity suites. This allows reports to be developed and results presented in a meaningful manner.

### Risks and over-extension

There are some significant risks associated with spreadsheet use for complex modelling. Some of these are:

- calculation times associated with complex models can be very slow;
- the error rates found in spreadsheets can be unacceptably high. Errors can occur due to interdependence of formulae and variables within, or the copying or multiple incidence of formulae that aren't updated consistently. The worst case scenario is that an error is never recognised; best case is that the errors may be difficult to identify and trace, so consuming time and resources;
- keeping track of different versions of a spreadsheet and associated models for audit purposes can be challenging and is usually a manual user process. This causes real concerns for audit functions, and even with

- significant documentation within the spreadsheets, the audit trail may not be clear. It can also be challenging to spot the difference between similar looking spreadsheets, or reverting to a previous version of a model;
- integrating a model with different data sources is not always straightforward and may involve linking spreadsheets. Updating these links is important and may lead to erroneous results if the updating process fails;
- adherence to emerging modelling standards, such as the Board for Actuarial Standards' "Technical Actuarial Standard: Modelling (TAS:M)" is in many instances a requirement if the information obtained from a model run is used in reports and decision making. The implication is that models should be robust and reliable, and care has to be taken to ensure that the spreadsheet implementation is reliable and error free; and
- sharing models with different access levels and adequate security can be demanding in a spreadsheet environment. It is essential to ensure that only authorised persons make changes to models and assumptions, and that these changes are tracked.

The list presented above is by no means exhaustive; a simple search on the Internet for spreadsheet errors and risks will produce a compelling list of costly errors. The over extension of spreadsheet modelling to embrace new technology could make matters worse and introduce significant operational risk to a business, as well as audit and standards compliance issues.

### Reducing the risk

Many of the risks involved in spreadsheet modelling can be limited by using good model development techniques, coding standards and validation, and testing methodology. With great importance placed on model accuracy and reliability, it is important to make sure that models are producing accurate and error-free results. The following principles can ensure that some of these risks are managed:

- thoroughly document models, making sure to add comments to formulae and code. The overall purpose of the model and assumptions used in it should also be documented. Documentation production should be integrated in the development process;
  - separate the data and model calculations. This will make it easier to update data without the risk of changing the model implementation or functionality. Keep values that users are likely to change, e.g. model parameters, on a single sheet. This allows easy access to changes and allows formulae to be placed in a different location so that they can be protected from unintentional changes;
  - a change log will help track changes in spreadsheets and can help improve accountability;
  - a clear security and audit policy should be developed: use of passwords and protection of cells, so that formulae and worksheets
- are protected from accidental or unauthorised changes;
  - consider using named ranges to make formulae more descriptive. This combined with a good naming convention can make formulae self-documenting. If appropriate, try to implement relative addressing, e.g. R1C1, rather than absolute references to ensure that the correct values are used in formulae;
  - if possible, break complex formulae into smaller, more manageable parts. There is, however, a trade-off between simple formulae and complex workbooks. Breaking formulae into too small parts may create unwieldy spreadsheets;
  - consider using macros, where the same tasks are performed several times. A macro may eliminate errors by applying a tested process, and may also save time. Ensure macros are fully documented within the code and the inter-relationship between macros and worksheets is also documented. Having a macro that 'invisibly' updates worksheets may be a less acceptable risk than having an auditable formula on the worksheet, even if this is more complex; and
  - ensure that a summary or test worksheet is included in the workbook that summarises model outputs with reference to some known baseline results so that errors can be easily identified.

This is a short list of possible enhancements that can be made to a spreadsheet-based modelling process. There are numerous projects and initiatives aimed at improving spreadsheet-based modelling, including the FAST modelling standard and the Spreadsheet Standards Review Board ("SSRB") standards. It is evident that it is a difficult task to create a 'one size fits all' standard for financial modelling with spreadsheets. However, the value to an organisation of a well documented

and reviewed modelling process which is pragmatic and proportionate should not be underestimated.

### How can OAC help?

There are tools on the market which can be used to replicate and extend spreadsheet methods whilst mitigating risk and providing additional controls. An organisation developing complex models within spreadsheets could potentially introduce unacceptable risks and should consider moving their modelling activities into a financial modelling software package. OAC uses the Mo.net® financial modelling software that has many advantages over spreadsheet-based modelling and calculation. The system can perform basic modelling tasks such as spreadsheet replacement through to complex full stochastic modelling for Solvency II. Within the Mo.net system models are constructed with the option of extensive code reuse and inheritance, so mitigating risk and improving time to develop models. Mo.net is built on the Microsoft .NET Framework, and is a very efficient and powerful calculation engine. Results can be accessed through a free Excel add-in which gives access to all the advantages of data manipulation, visualisation and representation in Excel, while using the advanced computational capabilities of Mo.net.

If you would like to discuss further any of the issues raised in this article, or request a trial of the Mo.net financial modelling software, please contact me.

**David van der Merwe**  
**+44 (0)20 7278 9500**  
**david.vdm@oacplc.com**  
**oacplc.com/financialmodelling**

Copyright © 2010 OAC plc. All rights reserved.



### Subscription to OAC publications

OAC has been writing commentary on industry events since 1994 and has become a trusted source of independent expert advice and guidance. OAC now produce a series of free publications which focus on specific areas, sectors and groups in the financial services industry, covering topics such as actuarial, compliance, complaints, regulatory reviews, and regulation. We generally only produce publications when something interesting happens that we feel we can usefully comment on. Readers also benefit from being in easy reach of OAC consultants if they have any questions about the issues covered in our publications. See all our latest publications at [oacplc.com/publications](http://oacplc.com/publications).

If you are not already subscribed, we invite you to do so at [oacplc.com/contactus](http://oacplc.com/contactus).



### OAC Actuaries and Consultants

Portsoken House Minories London EC3N 1LJ  
[www.oacplc.com](http://www.oacplc.com) [enquiries@oacplc.com](mailto:enquiries@oacplc.com)

OAC Actuaries and Consultants is a trading name of OAC plc  
 Registered in England No. 4663795