

Spreadsheet use in Solvency II Internal Models

Jothi Philip
Financial Services Authority
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Agenda



- FSA Data Review
- Spreadsheet use in Internal Models
- Spreadsheet controls
- Conclusion
- Questions

FSA Data Review - Background



- We are conducting a risk based review of IMAF firms to gain comfort over how firms are managing the quality of data (accuracy, completeness and appropriateness) that is used for the Internal Model (IM).
- The data review for systemically important firms is split across four key areas
 - Approach (i.e. policy & procedures)
 - Governance (i.e. oversight of policy implementation)
 - Understanding (i.e. risk and materiality assessment, data directory documentation, etc)
 - Data and IT controls with focus on higher inherent risk areas such as **manual transformation of data using EUC tools (e.g. spreadsheets)**

FSA Data Review - Process



The review of sample firms takes the form of the following 3 ACTS



- **Discuss and agree the scope & timing of work for the data review with the firm.**
- **Firm commissions independent data review as per scope and report results to FSA. Typically Internal Audit performs review**
- **Review of data audit findings and discussion of significant matters and remedial actions with firm.**
- **Conduct a deep dive of any particular area of concern.**

We have currently completed ACT1 for all of our sample firms and ACT2 for a few London market firms

End User Computing (EUC)



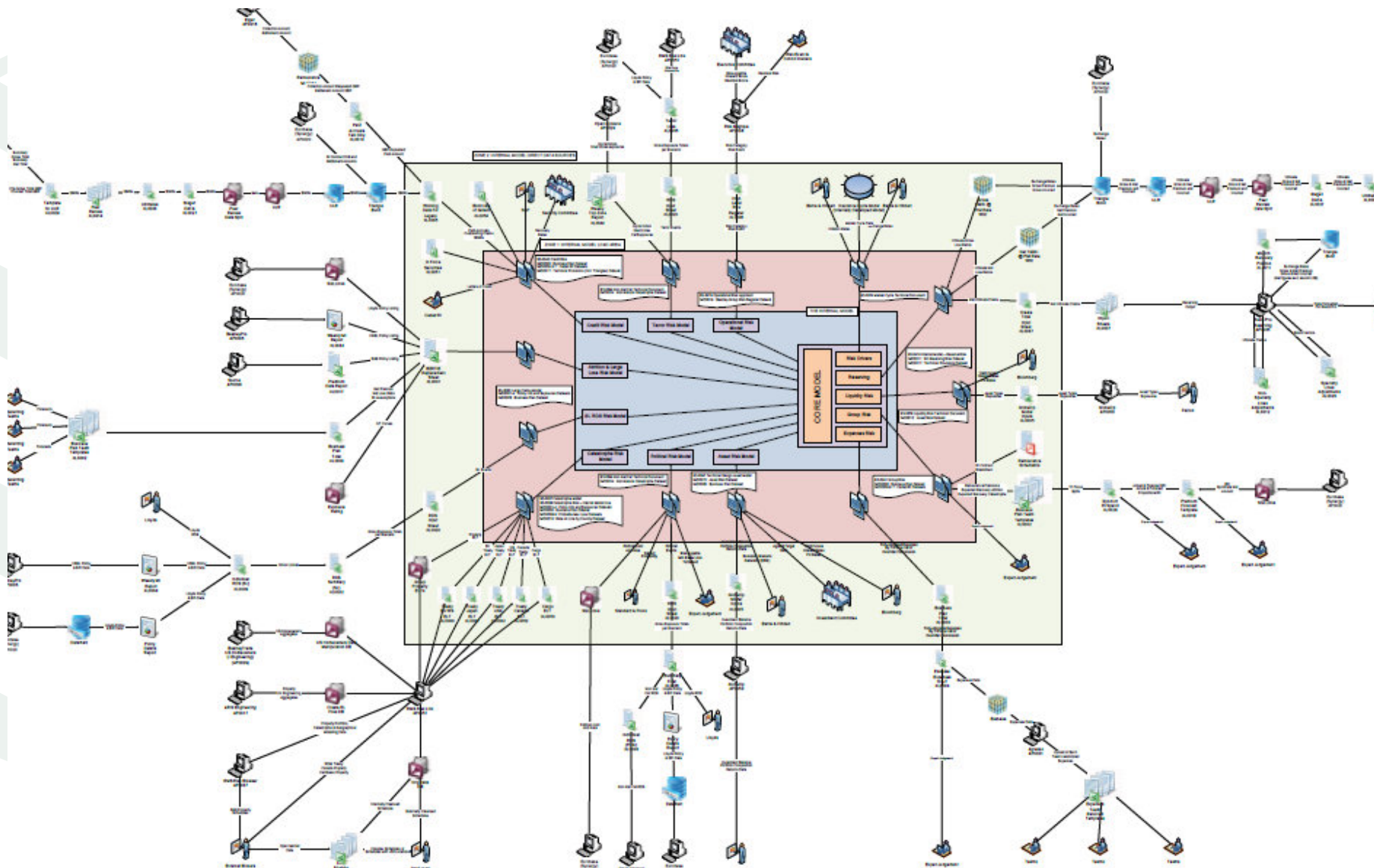
- Cheap, versatile, easy to use software (e.g. Excel, Access) with limited dependence on intermediaries such as IT department
 - In use everywhere
 - Often starts as temporary solution which becomes incorporated into BAU operations
 - Popular with actuaries and accountants
- Used for many purposes including data manipulation and aggregation, calculations, system interfaces, ETL, reporting, models, curve fitting etc
- Operational risks facing EUCs are the same as any other technology platform

FSA Data Review - Findings



- In almost all audit reports to date, we have seen issues with the use of spreadsheets. For e.g.
 - Lack of an appropriate policy and standards
 - Inadequate enforcement of existing policies and standards
 - Inadequate understanding of critical spreadsheets used in Internal Model
- Uncontrolled spreadsheet use can have a significant impact on data
 - Integrity (accuracy, completeness),
 - Confidentiality, and
 - Availability.

Spreadsheet use in Internal Models



Typical examples of use



- Extract, transform and load
- Liability modelling
- Fitting loss functions
- Capital modelling
- Capital aggregation

Extract Transform and Load (ETL)

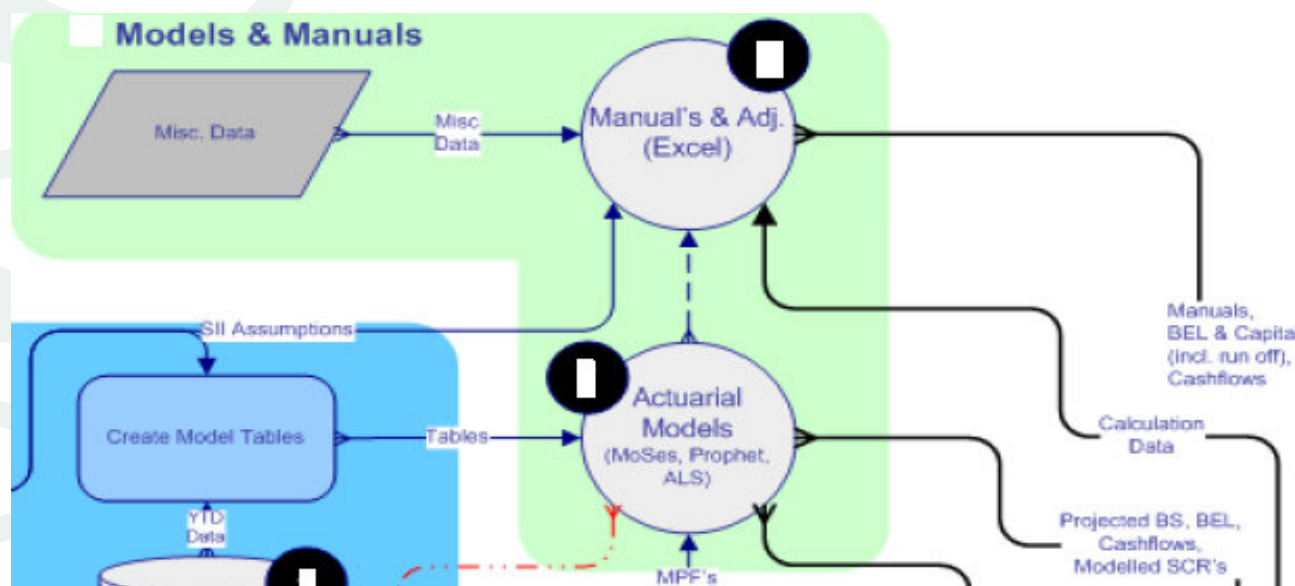


Typically there are four main layers of ETL use in an Internal Model data flow:

- From source admin systems to a data warehouse
- From data warehouse to reserving process
- From reserving to capital modelling
- From capital modelling to management information

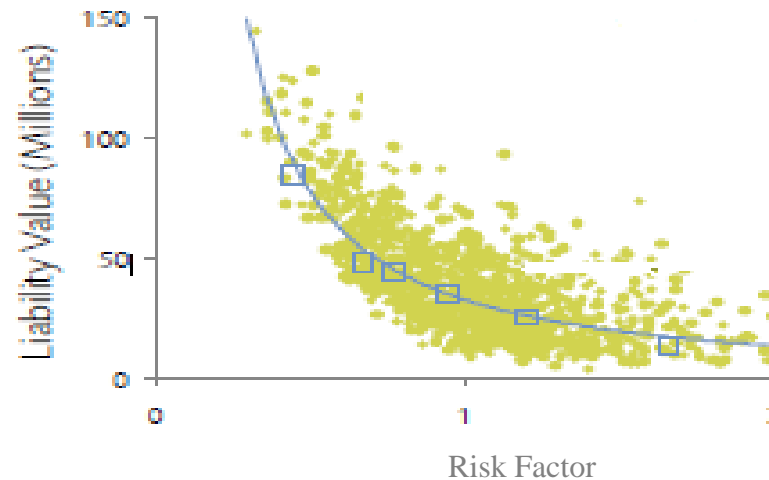
Liability Modelling

- **Inputs:** policy exposure data
- **Function:** Liability modelling for those risk exposures which are not modelled using Prophet, Moses, etc
- **Outputs:** Best estimate liability
- Typically used for less material products. One firm had 90 such spreadsheet models



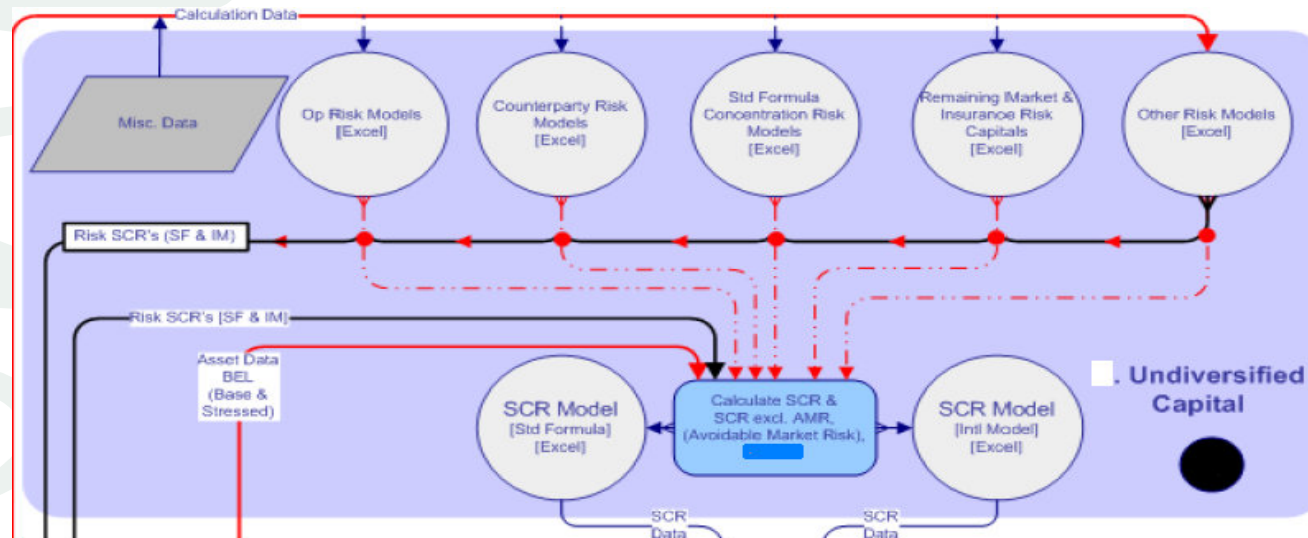
Fitting Loss Functions

- Loss functions map financial loss to risk factor values (e.g. FTSE equity return, wind strength)
- **Inputs:** Stress test results, Risk factor distributions, Roll forward parameters, Tax assumptions
- **Function:** Loss functions are fitted to stress test results using expert judgement.
- **Outputs:** Fitted loss functions



Capital Modelling

- Solvency Capital Requirement (SCR) correspond to the Value-at-Risk of the basic own funds of an insurance or re-insurance undertaking subject to a confidence level of 99.5% over a one year period.
- **Inputs:** Results from the Asset and Liability Models
- **Function:** Capital modelling (Standard Formula and Internal Model) to generate SCR for Operational risk, Counterparty risk, Concentration risk, Market risk, Insurance risk, etc.
- **Outputs:** SCR, MCR



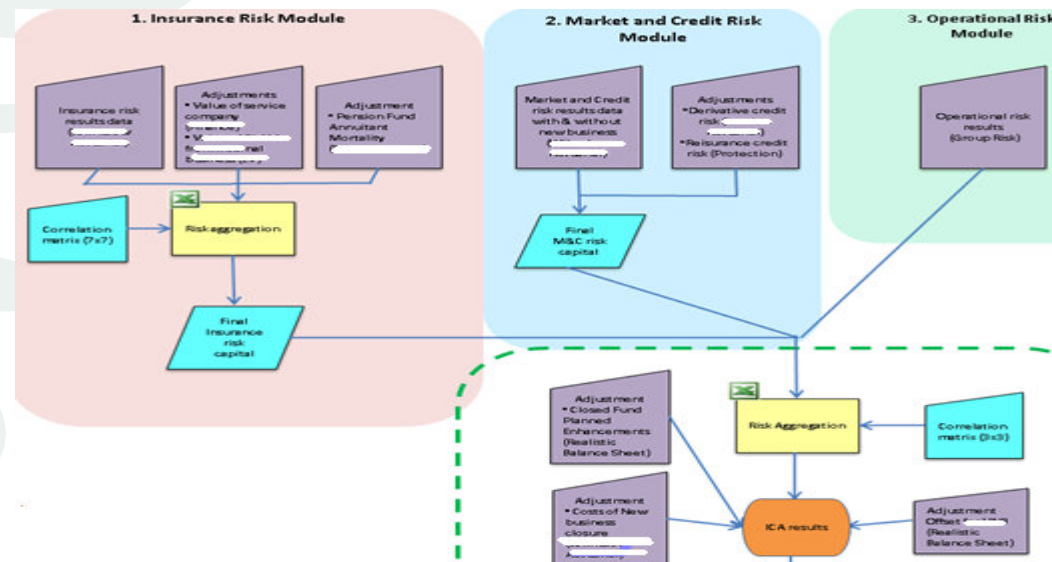
Capital Modelling – Example



- A large Life insurance firm uses eight spreadsheets for capital modelling. The total time taken for processing is approx 15 hours.
- One of the spreadsheets is 1 MB in size, with 12 sheets and 6770 lines of VB code. Another spreadsheet is 10 MB in size, with four sheets and 1521 lines of VB code.
- A large number of realistic simulations of how risk events might transpire are generated to calculate the impact of each on the balance sheet.
- The required economic capital for each individual risk is calculated by comparing the normal balance sheet position to the balance sheet under stressed conditions. Each balance sheet (stressed or normal) requires a run of the cash flow projection models.
- To avoid nested stochastic calculations, replicating portfolios (assets with cash flows that mimic the liabilities) are used.

Capital Aggregation

- **Inputs:** Market, Credit, Insurance, Operational risk components of SCR
- **Function:** A capital aggregation spreadsheet calculates the total required economic capital for all risks by aggregating the required capital amounts for each of the individual risks and using a correlation matrix to allow for dependencies between risks.
- **Output:** Aggregated SCR results
- E.g. 6 Mb size, 25 sheets



Where spreadsheet use has gone wrong

– Example one



- Most firm models use simulation techniques to combine severity and frequency distributions. Such techniques are based on generating random numbers that are uniformly distributed, and converting these into random numbers distributed according to desired laws.
- We have come across some firms that perform Monte Carlo simulations for capital calculations using an earlier version of excel. These spreadsheets will typically have a "period" of less than 35,000, i.e. they can only generate 35,000 random numbers after which they start to repeat. Firms were using this to generate "100,000 independent random numbers", which gave them a lot less randomness than they thought they had - and therefore the wrong capital estimates.

Where spreadsheet use has gone wrong

– Example two



- Until Jan 2011, positive or negative signage of the notional value of the CDS in a system denoted protection bought or sold.
- During a project to automate and improve CDS data processing, the format of the relevant data fields were changed; now the notional values were all positive and differentiation for bought and sold was within the “asset descriptor” field.
- From January 2011 onwards, all CDS were reported, in an excel report, as having a positive notional. The “asset descriptor” field was ignored by the downstream users of the report.
- It appeared as if the company had just purchased a large volume of CDS. The error contributed to approx £89m positive investment variance in respect of this adjustment.

Is there a silver lining to this cloud?



- Firms are defining and rolling out EUC standards / guidelines
- Spreadsheet ETL layers are being replaced by sophisticated scripting languages such as SAS, DCS, Informatica which are more tightly controlled by IT.
- Industrial strength data warehouses and data marts are being built for data storage.
- Critical spreadsheets are being identified in the material data flows and reduced in number
- Spreadsheet management software such as CIMCON, Cluster Seven, and Finsbury are being used.

Rationalisation of spreadsheet use – Example



Spreadsheet Categories	Current State	Target State
Assets Feeds & Stresses	10	6
Non Modelled Risk Capital Modules	17	17
Risk Margin	12	7
Risk Geographies Process	20	15
Aggregation/Consolidation (incl diversification)	10	8
Accounting Process	6	2
Analysis of other metrics / reconciliations	4	4
Analysis of Surplus	5	5
Standard Formula Process	11	11
Out of Model Manual Liabilities (Solvency II Basis)	16	32
Out of Model Manual Liabilities (Solvency 1 Basis)	304	109

Spreadsheet Controls – what we have seen at firms



- Enterprise wide policy, standards and guidelines
- Inventory of critical spreadsheets
- Assigning ownership and responsibility over each critical spreadsheet
- Standard IT GC controls such as
 - Information Security
 - Change Management
 - Disaster Recovery
- Consistent formatting and style distinguishing inputs, outputs, calculations, constants, etc
- Data quality checks on accuracy, completeness and appropriateness of the inputs and outputs
- Knowledge/Resource management including documentation

Conclusion



- Spreadsheets are widely used in Internal Models primarily due to their ease and flexibility of use, and a short lead time from concept to production roll out.
- When spreadsheets become part of the enterprise infrastructure and are controlled through a formal IT processes, it loses the very attributes that made it attractive in the first place.
- However, if a spreadsheet is critical to your business, then it needs to be appropriately controlled.
- Insurance firms are increasingly aware of the risk of uncontrolled use of spreadsheets and are rolling out EUC standards and governance in the capital modelling space.



Any Questions?