Capital Modelling in R

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17 January 2018

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What is R?

- R is an open source language and environment for statistical computing and graphics.

- It has strong statistical roots and is good at data analysis and visualisation.

- It effectively handles and manipulates large arrays of data.

- Base R is augmented by numerous packages which layer on top additional functionality.

- It is interfaced using an R IDE (integrated development environment) such as R Studio.

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R in actuarial work

- Pricing
  - Uses for personal lines pricing as has a natural affinity with building predictive models such as GLMs.
  - Used in some London Market pricing where R's stochastic functionality is preferred to Excel or @Risk.
- Reserving
  - There are packages in R that can parameterise and apply standard reserving methods. R cannot replace the softer skills required in a regular reserving process.
  - R might be more useful in individual case reserving.
  - R could be used in a technical provisions waterfall process.
- Capital modelling…

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What is open source software?

- R is open source software meaning it has source code that anyone can inspect, modify and enhance.

- This means that each business can tailor it to meet their needs.

- Open source software is widely-used. Examples include Android and Mozilla Firefox.

R vs Python

Analysis Tool	Similar Superhero	Super Powers in Common
R	Batman	• Detective Work • Intelligence • Cunning • Usage of Tools • More Brain than Muscles
Python	Superman	• Muscle Power • Super Strength • Elegance • Wide Range • More Muscles than Brain

Borrowed from @AntoineTrdc

Capital modelling software options

Proprietary software (also called closed source)

- Igloo by Willis Towers Watson
- ReMetrica by Aon Benfield
- Tyche by RPC Consulting
- Other

A licence is needed to use it.

An alternative to proprietary software is to build a bespoke capital model using open source software such as R.

To code or not to code…

- To spark a lively debate in my office, I can ask: "Which is better? Excel or R?"
  - *the best answer is, "It depends on what you're doing."*
- The existing proprietary software solutions are certainly not Excel, but often the debate pivots around the pros and cons of coding.
- It is as easy to write bad code as produce bad models in other packages
- A front end is often designed with the explicit purpose of providing a no-coding option for those less inclined

Purpose of model

- Should R be used for capital modelling?
- Similar to the previous slide, the best *answer is, "It depends on what you're doing."*
- Consider the following varied uses:
  - If we were producing a high level validation model, would R be a good solution?
  - If we were building a specific module which interacts with the main model as a set of pre-simulated simulations, would R be a good solution? e.g. operational risk
  - If we were talking about the parameterisation work that is often done outside the 'main capital model', would R be a good solution?
  - If the complexity of the intended model were low, would R be a good solution?
  - If we were moving from MS Excel, would R be a good solution?
  - If we were calculating regulatory capital, would R be a good solution?

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Factors to consider when selecting modelling software

- Functionality: ease of use and ability to build to a technical specification.
- Costs: set up fees and ongoing costs.
- Resources: talent pool and specialisation of knowledge.
- Performance: speed and constraints.
- Longevity: ongoing development environment and vendor support.

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Benefits of using R

- Complete developer freedom with the ability to build libraries in other languages to support the main R build.
- Can call upon many statistical libraries already developed by the R community.

- No annual licence fees for software.

Benefits of using R (continued)

- Insurers are likely to already have individuals who are skilled in using R.
- Can hire from other industries meaning a cheaper, more sustainable resource pool.

- Can be faster than some current proprietary models.

- Supported by a vibrant community.
- Not reliant on a single vendor.

Frequently Asked Questions

Question	Answer
Can a capital model built in R be hacked?	R uses base code and library code. Unlike other software packages, this code is open source and freely available. Though it is possible for this code to be maliciously altered it is unlikely given the governance around code checking and approval of official updates.
How is support to R provided?	There are a large number of freely available courses and tutorials online as well as through the R foundation. Due to the large numbers of R developers, support is best sought through the R community or a friendly R expert.
Is it compatible with other packages such as MS Office?	Yes, R can link to a variety of data sources and works well with many packages such as MS Office. Output reports can be sent directly to Word or PDF assisting with documentation.
Will a model built using R get IMAP approval?	There is no reason why not. R can be more transparent than proprietary software which can make some aspects of validation easier. IMAP approval does not suggest or require any particular software solution.
Is it cloud-ready?	Yes, it can be implemented locally or using cloud technology.

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Questions?

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