MILLIMAN WHITE PAPER

Insurers, spreadsheets and model risk

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In the age of 'black box' actuarial modelling systems and coding specialists, actuaries are still placing significant reliance on their most familiar tool - spreadsheets.

Spreadsheets are powerful, versatile and accessible to almost anyone. It is no surprise therefore that across all business functions actuaries and other insurance professionals consistently turn to spreadsheets to perform a huge variety of tasks of differing complexity and materiality, ranging from simple calculations to tools used to inform material business decisions.

During the Institute and Faculty of Actuaries' Life Conference and the Association of Financial Mutuals Conference in 2018, Milliman surveyed 183 actuaries and insurance professionals from over 70 different companies to discover how spreadsheets are used by life insurers and reinsurers, and to identify potential improvements that could be made to this key tool.

In this article we analyse the results of this survey, highlight our key findings and consider the benefits and risks arising from reliance on spreadsheets.

Extent of spreadsheet usage

DEPENDENCY

When asked how reliant they were on spreadsheet usage, 61% of those who responded stated that their team uses spreadsheets extensively. Similarly, when asked, 67% of those who responded stated that spreadsheets are of critical importance to their team.

FIGURE 1: IN YOUR TEAM, HOW RELIANT ARE YOU ON SPREADSHEETS, IN TERMS OF USAGE?

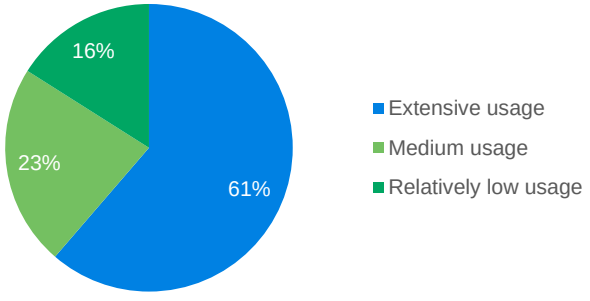
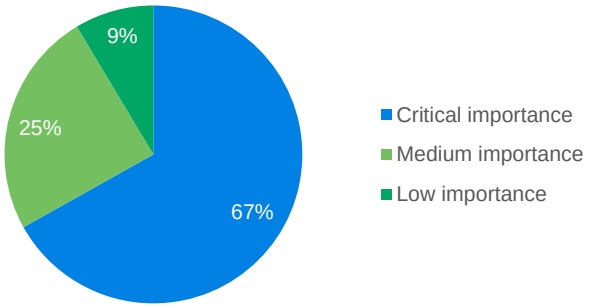


FIGURE 2: IN YOUR TEAM, HOW RELIANT ARE YOU ON SPREADSHEETS, IN TERMS OF IMPORTANCE?

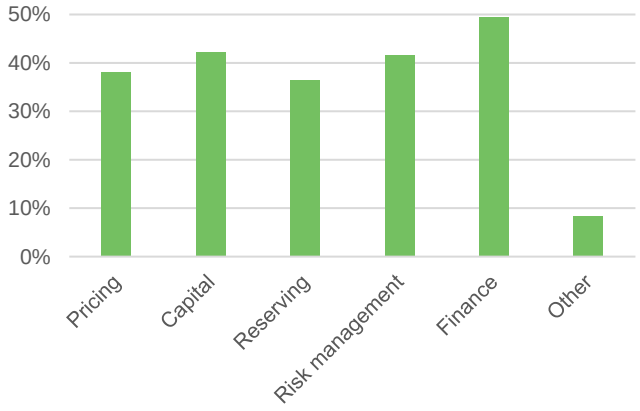


Of those that declared that their usage was relatively low and answered both questions, over a third still went on to also say that they considered spreadsheets to have medium or critical importance within their team. In contrast, of those that answered both and whose usage was high, only 9% stated that spreadsheets had medium or low importance indicating that the importance is not simply dependent on how often spreadsheets are used.

BUSINESS AREA

We also asked how each respondent used spreadsheets, first in terms of business area and then in terms of the specific tasks performed. The even spread across all business functions, as illustrated in Figure 3, demonstrates the versatility of spreadsheets and their universal adoption.

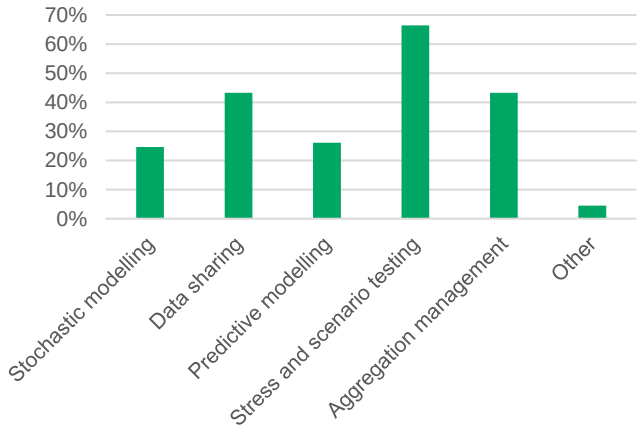
FIGURE 3: HOW DO YOU USE SPREADSHEETS? (BY BUSINESS FUNCTION)



Similarly, we asked respondents what tasks they performed using spreadsheets. The most common use was "Stress and

Scenario Testing", with 66% of respondents selecting this option – this is perhaps unsurprising as it is a key part of many aspects of actuarial work, from capital and risk management to pricing, finance and reporting work. "Data Sharing" and "Aggregation Management" were both selected by 43% of respondents whereas "Stochastic Modelling" and "Predictive Modelling" were each only selected by approximately a quarter of respondents, suggesting that other solutions may be more commonly used for more complex modelling with spreadsheets being used to aggregate, present and distribute modelling results.

FIGURE 4: HOW DO YOU USE SPREADSHEETS? (BY TASK)



The responses for each category were fairly evenly spread across all the business functions, showing that even within specific functions, the different uses of spreadsheets are wide-ranging. It is also clear from the responses that spreadsheets make up a material part of insurers' key activities, and results from spreadsheet models are likely to be used to inform key business decisions in areas such as Pricing and Risk Management.

Model risk

Model risk management ('**MRM**') is becoming an increasing area of focus for insurers. With the introduction of Solvency II and the resulting regulatory focus on internal models, most insurers have developed robust frameworks around their regulatory models. However, many firms are recognising the need for a wider model risk management framework.

A key aspect of MRM is improving the governance framework that surrounds spreadsheet models. As shown in Figure 1, spreadsheets are widely used and this may be largely attributed to their flexibility and ease of use. Their widespread use across insurance companies and business functions can help to reduce model risk, as they require less specialist expertise compared to other modelling tools. This makes spreadsheets easier to review and can also reduce key person risk. However, in spite of this, spreadsheets can often be poorly governed and, as they can drive key decisions made by a business, they can be a key source of model risk that is often overlooked.

HOW MODEL RISK ARISES

The modelling platform selected by a firm can either alleviate or introduce unnecessary risk into a model and, as demonstrated by our survey, Excel is one of the most commonly used modelling tools in the industry. While it does have many advantages, these can often lead to some challenges as part of a MRM framework. For example:

- It can be difficult to build and evidence robust controls and governance processes around spreadsheet models, and where such controls *are* implemented they can often end up being manual, cumbersome processes which can fall out of use over time or only be partially implemented, a common example being version control tabs.
- A large proportion of errors are likely to arise from incorrect inputs or changes made quickly without the appropriate level of review, i.e. from human error, and so are unlikely to be recognised and reflected in a manual audit trail.
- Managing and updating large numbers of spreadsheet links within Excel models can easily result in errors or links to out-of-date versions of spreadsheets, introducing a risk that decisions will be made based on incorrect or outdated data.
- The use of VBA can also be problematic as it is unlikely that all model users will be able to write and understand VBA code. This introduces an extra level of necessary validation, and risks limiting the transparency of the model.

The lack of reliability arising from poorly governed spreadsheet models can be an expensive issue, as firms are required to spend significant amounts of time and resource checking models and their results and often delaying timelines where errors are found at a late stage in a critical process.

BENEFITS OF GOOD MODEL RISK MANAGEMENT

Good MRM reduces the likelihood of poor decision making as it can reduce the chance of material errors, increase the understanding of the model and its capabilities, and also give confidence to the users of the model output. Model results influence a huge range of decisions within a company, often with significant financial or reputational consequences, therefore it is vital that these models produce consistent, reliable results, and that users are aware of their limitations and appropriate use.

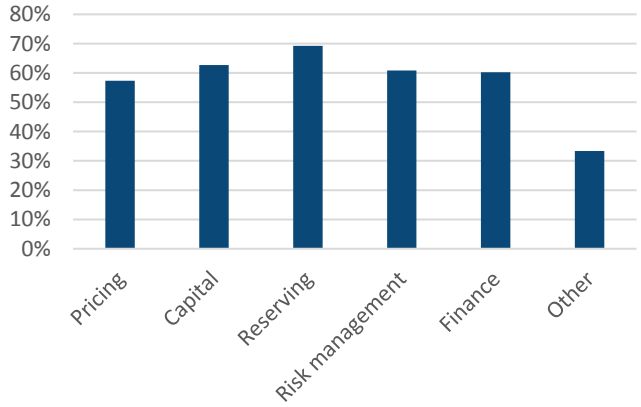
It is worth noting that in our view there are areas where other modelling platforms and 'black box' models are actually at a disadvantage relative to Excel. Such models often result in high costs and require significant time and specialist resources to manage, develop and use. The specialised code used in many proprietary models introduces key person dependencies, necessitates a dedicated coding and development team and carries a high risk of user error, particularly when training new

developers. Such platforms may also pose challenges for a MRM framework as they tend to be highly complex, opaque, and those using and reviewing the results often do not fully understand the coding language used. This can mean that model users therefore rely on high-level sense checks to validate the results.

The use of Excel alongside appropriate governance and controls enables improved knowledge and understanding which can allow faults, outdated information or erroneous inputs to be identified more easily and earlier by users. This can prevent errors occurring before they can evolve into complicated issues, potentially saving time, money and reputational damage.

There is therefore significant upside to continuing to use spreadsheets across actuarial processes, but to minimise the risk and maximise the effectiveness of spreadsheet models there is a clear need to incorporate some of the improvements outlined above.

FIGURE 5: PROPORTION OF RESPONDENTS IN EACH BUSINESS LINE THAT WOULD LIKE TO SEE AN IMPROVEMENT IN RELIABILITY OR GOVERNANCE ASPECTS

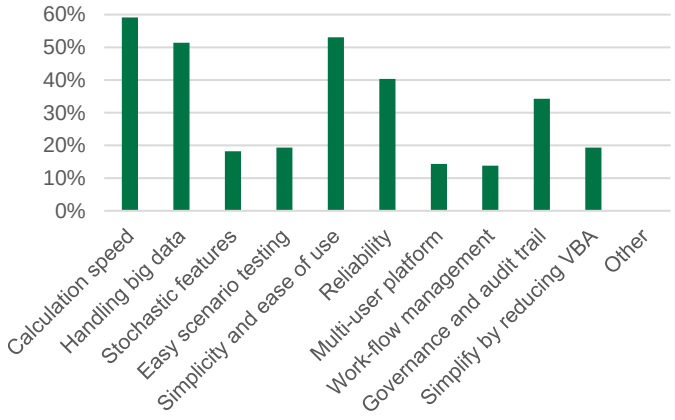


When asked about the potential improvements to spreadsheet models that would be beneficial, 54% of respondents stated that they would benefit from either improved reliability or improved governance and audit trail capabilities (or both), indicating that firms do recognise this need for improved spreadsheet model risk management. As shown in Figure 5, the desire for improved governance and reliability of spreadsheets was broadly similar across the various business functions, indicating that such improvements would benefit many parts of the business.

OTHER IMPROVEMENTS

On average, each respondent selected more than three potential improvements to spreadsheets that would be beneficial for their business.

FIGURE 6: WHICH OF THESE IMPROVEMENTS WOULD BE MOST BENEFICIAL TO YOU IN YOUR SPREADSHEET WORK?



As shown in Figure 6, as well as MRM features, other highly sought improvements included:

- Calculation speed (59%);
- An ability to handle big data (51%); and
- Simplicity/ease of use (53%).

This appears to reflect our earlier comment that spreadsheets are increasingly being used as a data management and aggregation tool, but indicates that progress in this area is perhaps being held back somewhat by slow and unreliable performance when using large or complicated spreadsheet models or running macros which “loop through” large sets of data. This may arise, for example when opening large files or running large macros, potentially because Excel shares computer power with other processes that are running simultaneously.

Perhaps because Excel is so widely used, and a required competency for many roles, a high proportion of respondents (53%) believed that spreadsheets could benefit from increased simplicity and ease of use. This may be reflective of the common issue where existing spreadsheet models are adapted over time, often without proper model change controls and documentation, meaning they tend to become ‘messy’ and can become overly complex and difficult to follow. One example that we see frequently in clients’ models is where inputs have been added to a tab in the middle of a large spreadsheet and not properly marked/documented and therefore get missed when the spreadsheet is updated. Similarly where the same inputs are required to be updated in a number of areas within a spreadsheet process, increasing the risk that an error is made and the time taken to produce revised results each time new information is provided.

Conclusion

As well as highlighting the results from our recent spreadsheet survey, this paper also demonstrates the need for good governance and controls in relation to key spreadsheet models. Given that over two thirds of those surveyed stated that spreadsheets were of critical importance to their team, we believe firms should be placing spreadsheet MRM high on their priority list.

It is widely quoted that roughly 90%[1] of spreadsheets contain errors and these can lead to some material consequences, both financial and reputational. However, the spreadsheet models themselves do not create model risk – this arises from our use and reliance upon them without the appropriate governance and controls. Therefore, whilst this may not be considered an issue for all spreadsheets, where spreadsheet models are being used to inform business decisions this poses a very real risk.

Simply by reviewing existing spreadsheets against 'best practices', for example having a dedicated inputs tab and taking the time to 'tidy up' more complicated models, firms could make significant improvements in this area. Similarly, automating the governance processes around these models could free up time and resources for other tasks and enable management to have more confidence in the model results and any decisions made which rely upon them.

How Milliman can help

Milliman consultants have extensive experience reviewing and streamlining clients' spreadsheet models against industry best practice and working alongside clients to assess and manage their model risk.

In addition, Milliman has developed an award-winning[2] Cloud-based modelling platform, Milliman Mind. Milliman Mind is a flexible and easy-to-use web-based platform which optimises and enhances your Excel spreadsheets by automatically converting them to powerful C# models. It provides a simple solution to many of the spreadsheet issues raised in this paper and addresses many of the related model risk concerns.

Milliman Mind includes:

- an automated audit trail which logs all changes made to data and assumptions, and allows reviewers to reverse individual unwanted changes with a single click;
- project management features which allow managers to allocate read/write access to each user and lock models once they have been validated to ensure replicability of results;
- additional governance features such as the ability to specify certain inputs as read-only;
- a user-friendly interface, accessible from any device with an internet connection, facilitating review and allowing users to securely share models across locations; and
- improvements in run-times as a result of conversion to C#, intelligent parallel processing and hosting in the Cloud.

Milliman Mind can therefore support firms in reducing spreadsheet model risk, via its in-built controls and governance features, and simultaneously enhance them by adding all of the capabilities of more expensive "black box" systems. Milliman Mind provides a "third way" between using Excel and choosing a more complex, specialised modelling solution.

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Milliman is among the world's largest providers of actuarial and related products and services. The firm has consulting practices in life insurance and financial services, property & casualty insurance, healthcare, and employee benefits. Founded in 1947, Milliman is an independent firm with offices in major cities around the globe.

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[1] https://www.forbes.com/sites/salesforce/2014/09/13/sorry-spreadsheet-errors/#62c3920956ab

[2] Best end-user computing risk management solution, 2018-2019 *InsuranceERM* awards