

XII

CONGRESSO NAZIONALE degli ATTUARI

Capital projections for Solvency

Leveraging from the SCR & Risk Margin
in an integrated framework

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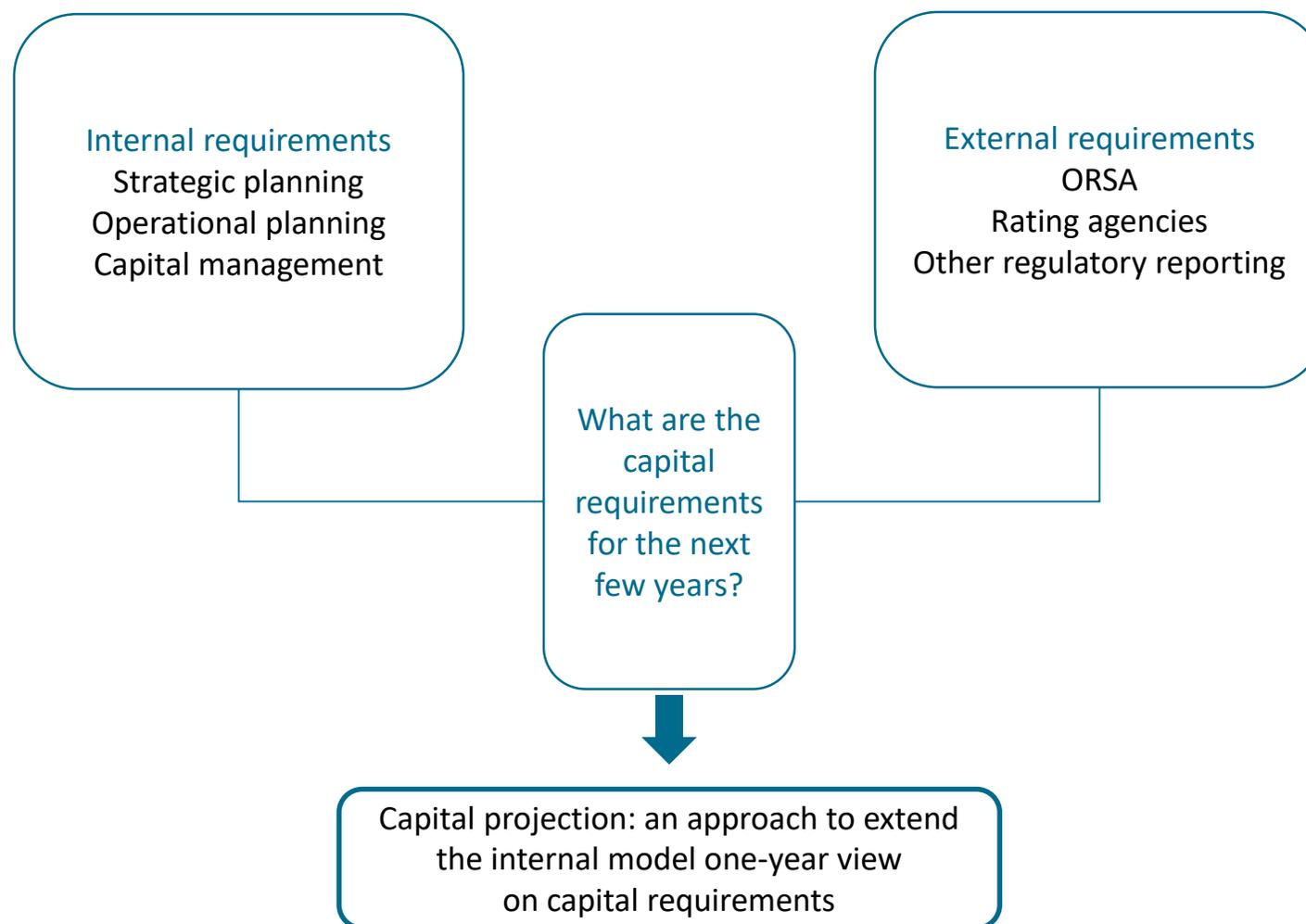
AGENDA

- 1 Introduction
- 2 A methodology leveraging from SCR and RM
- 3 Implementation and conclusions

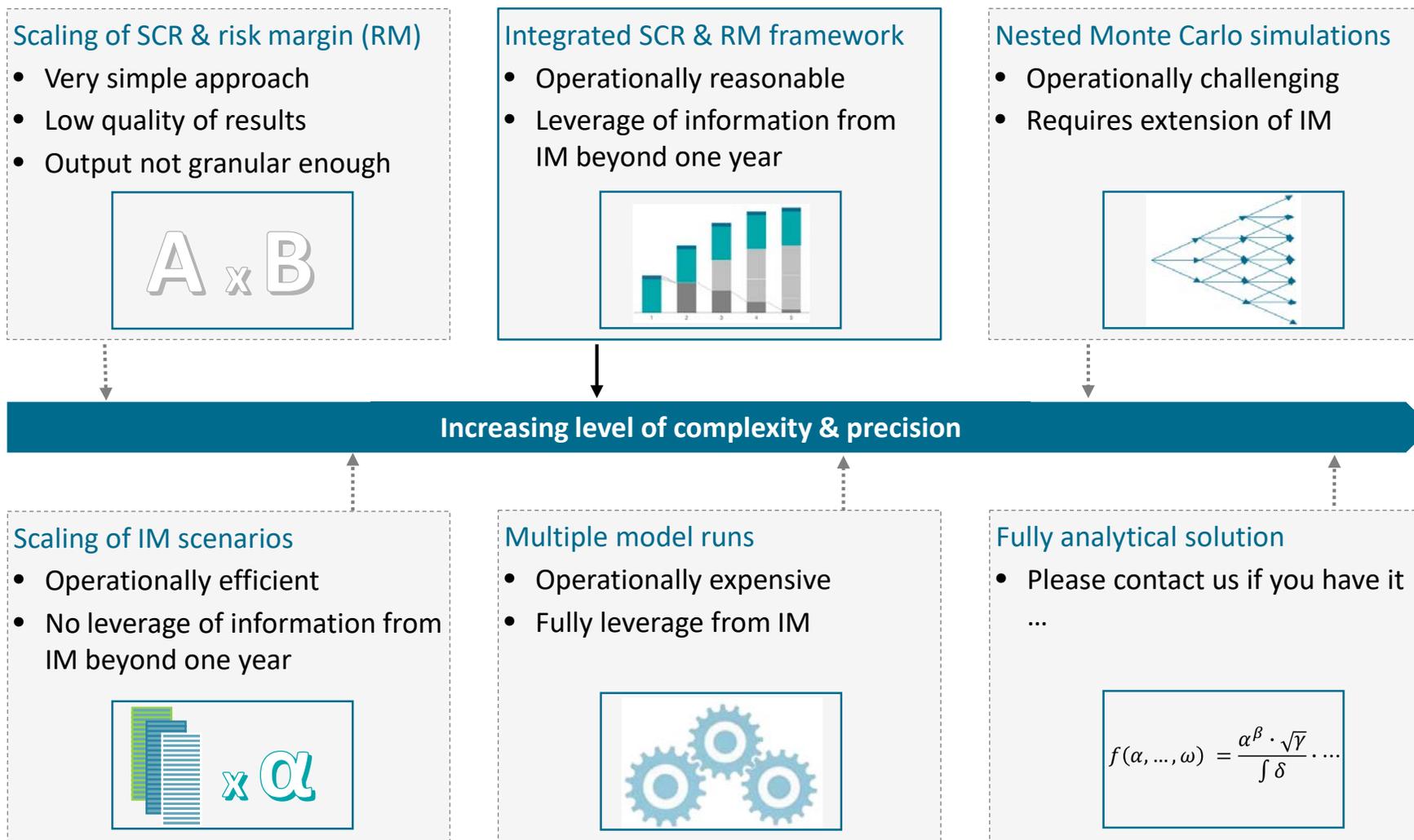
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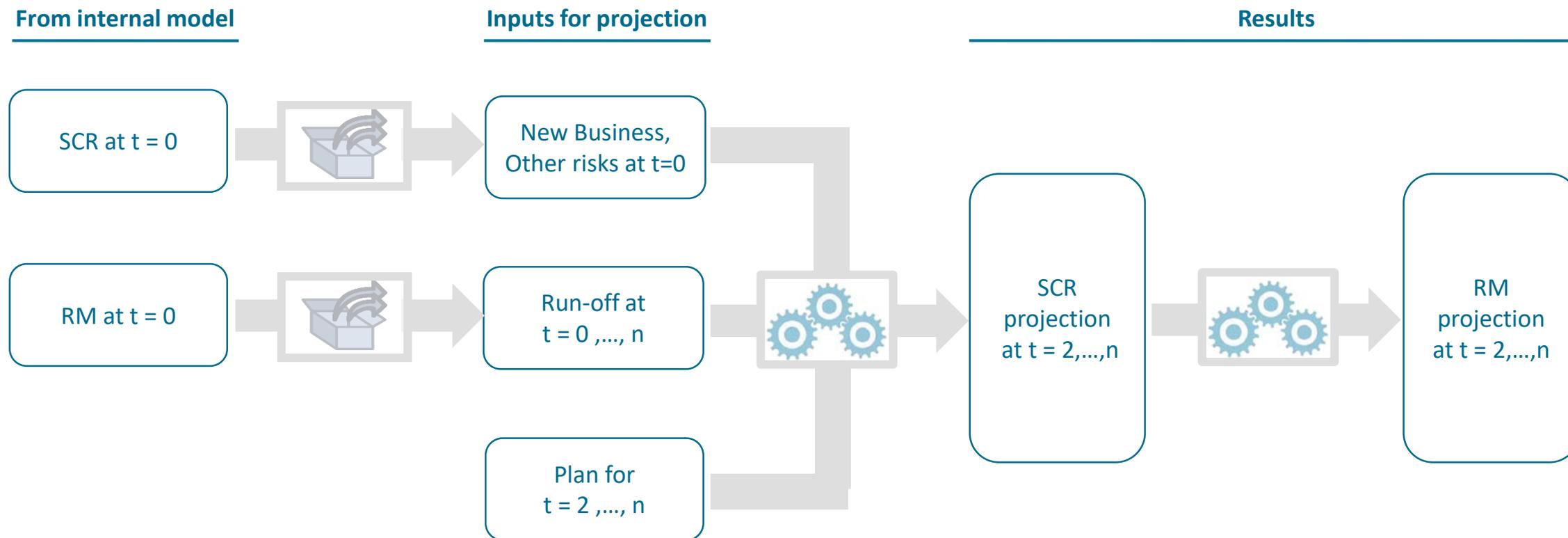
Let us face it, there is more to a plan than a one-year view ...



Our methodology aims at a balance between complexity and precision



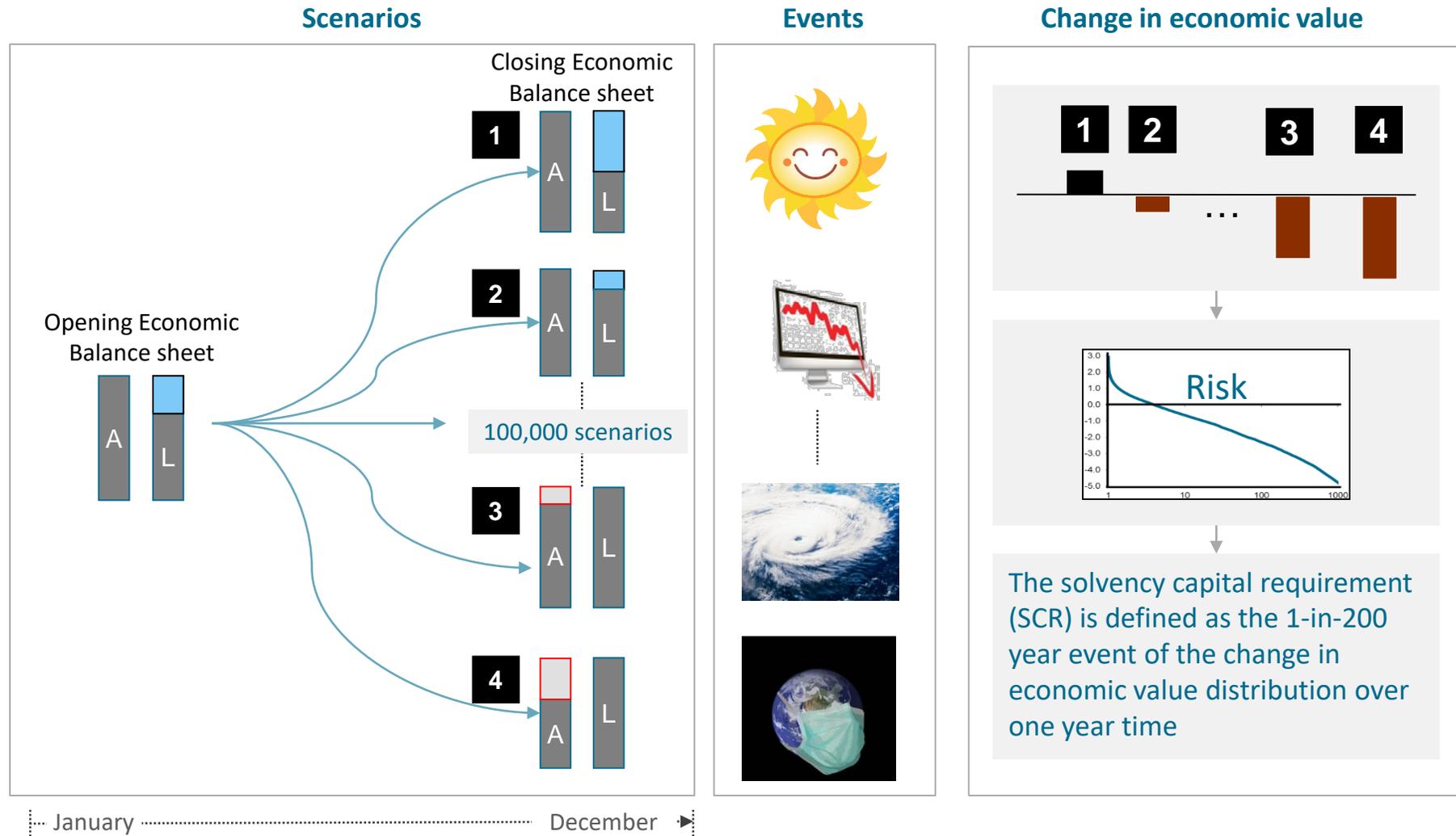
SCR and RM provide the basis for capital projections



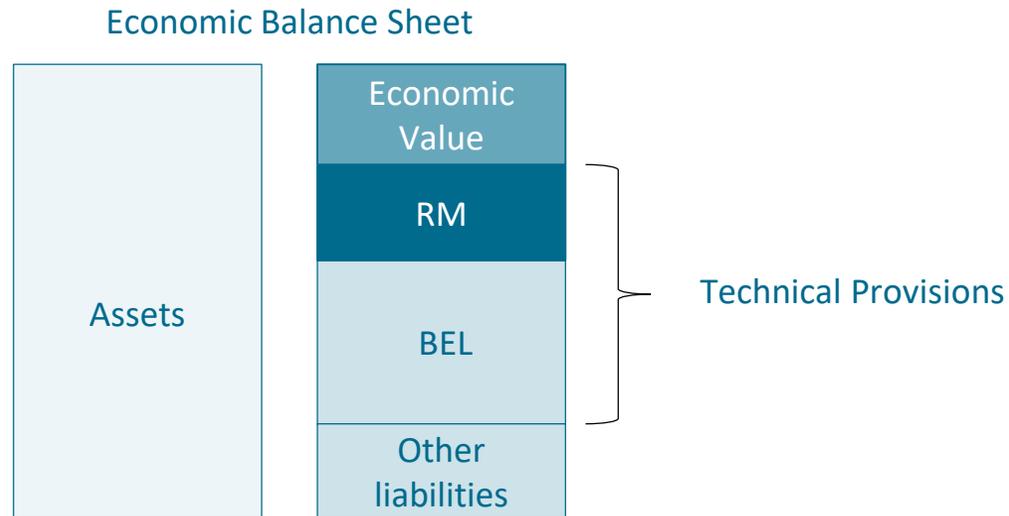
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A full internal model estimates the SCR based on a Monte Carlo approach



Risk Margin is a component of economic valuation



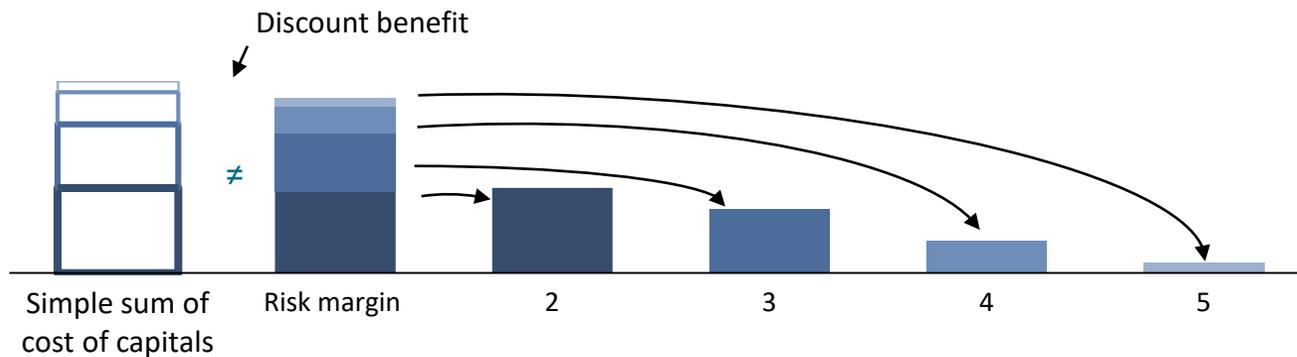
Risk margin

- The goal of economic valuation is to assign values to the balance sheet positions that are as realistic as possible. The resulting balance sheet is called **economic balance sheet**
- Market values are generally accepted for economic valuation purposes (**mark-to-market**), but they are only available for positions traded in deeply liquid markets. This is the case for many **asset** positions
- In contrast, there is typically no liquid market for **liabilities**, and hence their economic value needs to be approximated in a **market-consistent** way using models (**mark-to-model**)
- These models compute the **economic value of the liabilities** as the **present value of the best estimate liabilities (BEL)** plus a so-called **risk margin (RM)**
- The risk margin is the **risk premium** investors expect for the risks of the liabilities

Risk Margin is a component of economic valuation

The cost of capital method for the risk margin

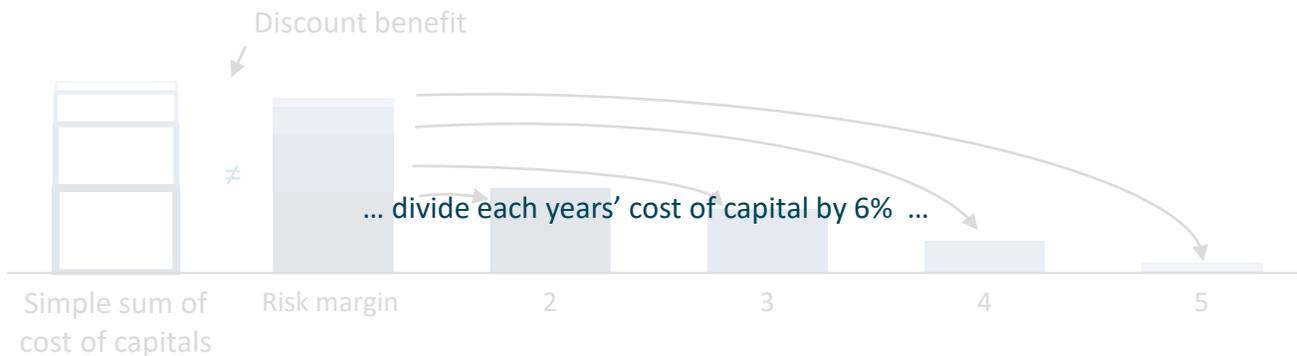
- The **risk margin** is computed as the discounted sum of all the costs of capital over all years
- The **cost of capital is set to 6%** according to Solvency 2
- The capital for each year is an input into the risk margin calculation and it is derived from the company-specific risk profile



Risk Margin is a component of economic valuation

The cost of capital method for the risk margin

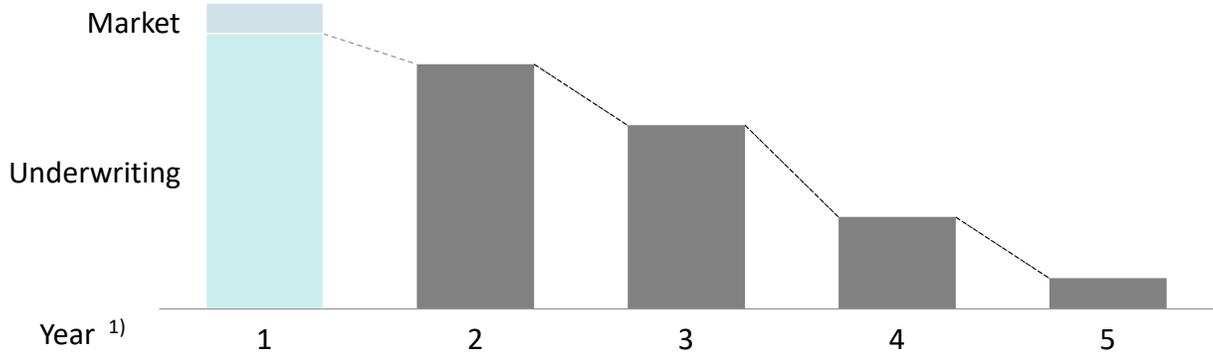
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Extracting this information provides a view on the run-off capitals and...

Step 1: Run-off

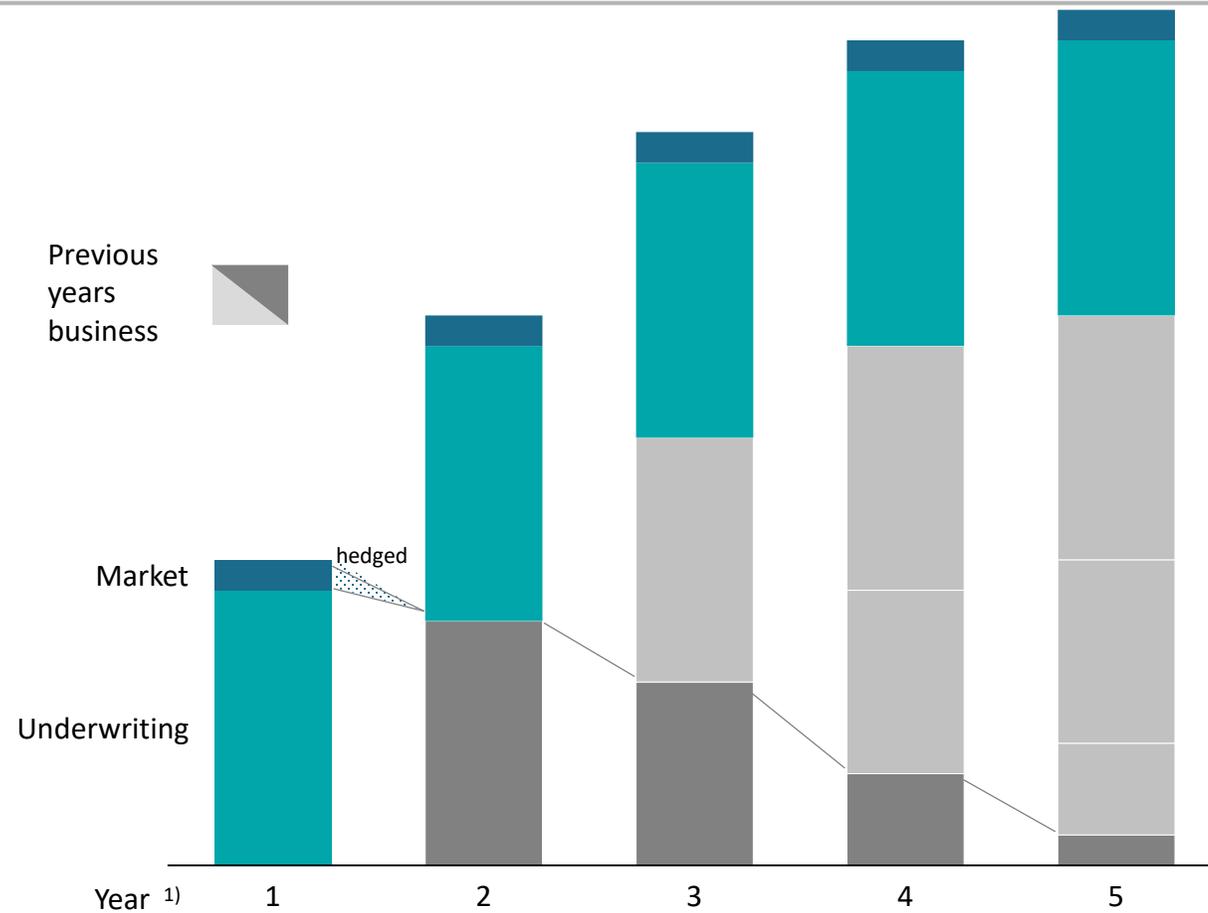
- The result of dividing the cost of capitals by 6% is the required capital in each year for the run-off case
- As an example to illustrate this, let us assume
 - “Simple Insurance” **underwrites only 1 casualty contract in its first year** and stops underwriting risks after the first year
 - **Underwriting risk lasts for several years** and capital needs to be provided accordingly²⁾
 - Credit and operational risk can be assumed as immaterial (for simplification)
 - Market risks can be hedged for future years; in the first year it is considered in the SCR



1) Year 1 starts at t=0 and ends at t=1 etc.
2) As this is a startup company, at t=0, no underwriting risks are on the balance sheet as rights and obligations, hence no risk margin contribution



...including future new business provide a methodology for capital projection

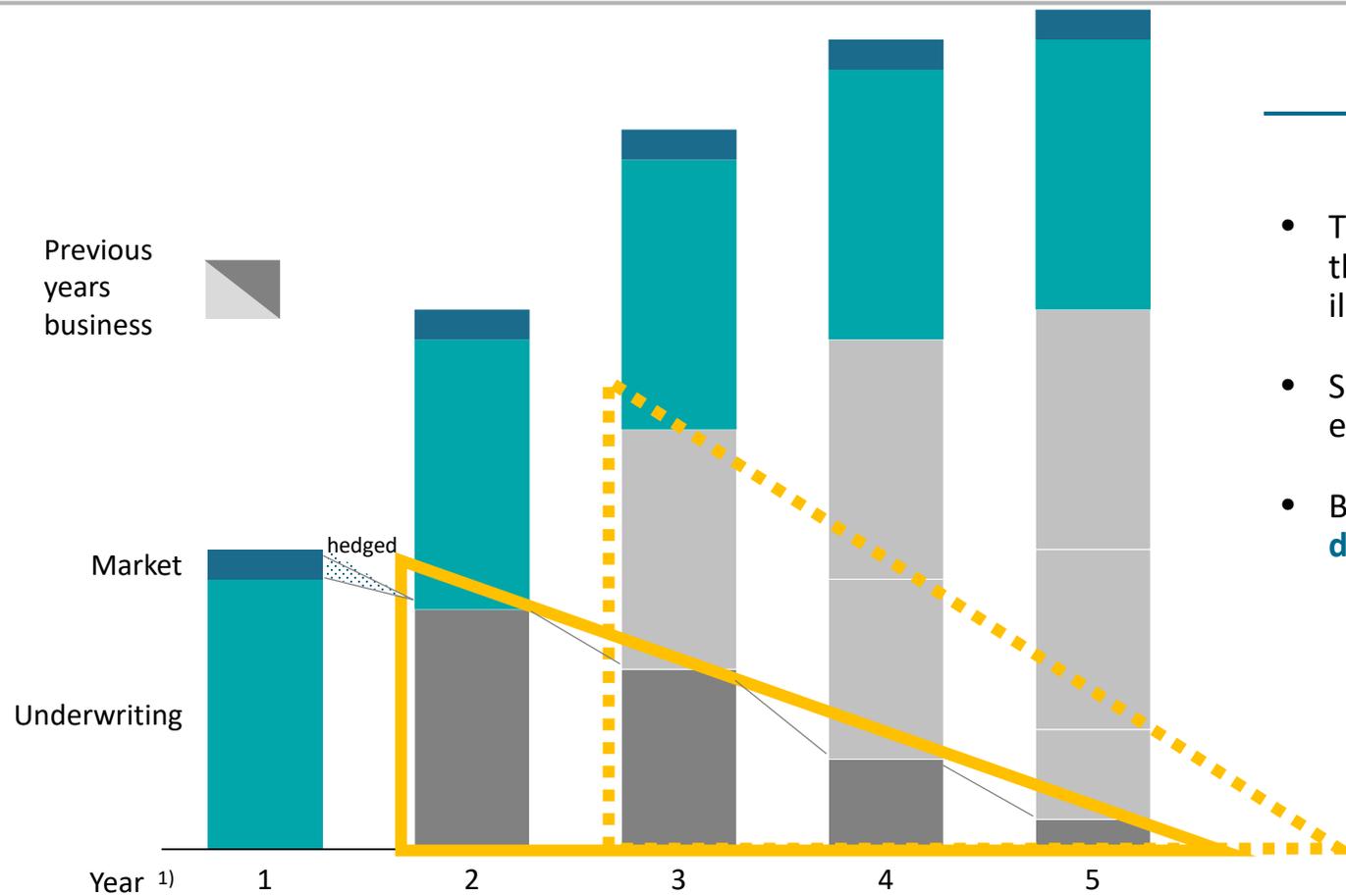


1) Year 1 starts at t=0 and ends at t=1 etc.

Step 2: Going concern

- To continue the previous example:
 - “Simple Insurance” **continues underwriting (the same risk) year after year**
 - Year-on-year a new layer of risks is added to reflect the new business, through scenarios scaling according to **plan**
 - Also, each year the previously existing business is fading out, as its risks vanishes over time
- The chart above shows the **projections of the required future capital**

The projected run-off component of the SCR allows to project the risk margin



1) Year 1 starts at t=0 and ends at t=1 etc.

Projected risk margin

- The risk margin at the beginning of year 2 is estimated based on the **projected run-off** components of the SCR as of year 2, illustrated in
- Similarly, the basis for the risk margin at year 3 are shown in , etc.
- Based on this inputs, the risk margin is calculated as the **discounted sum of all the costs of capital** over all years

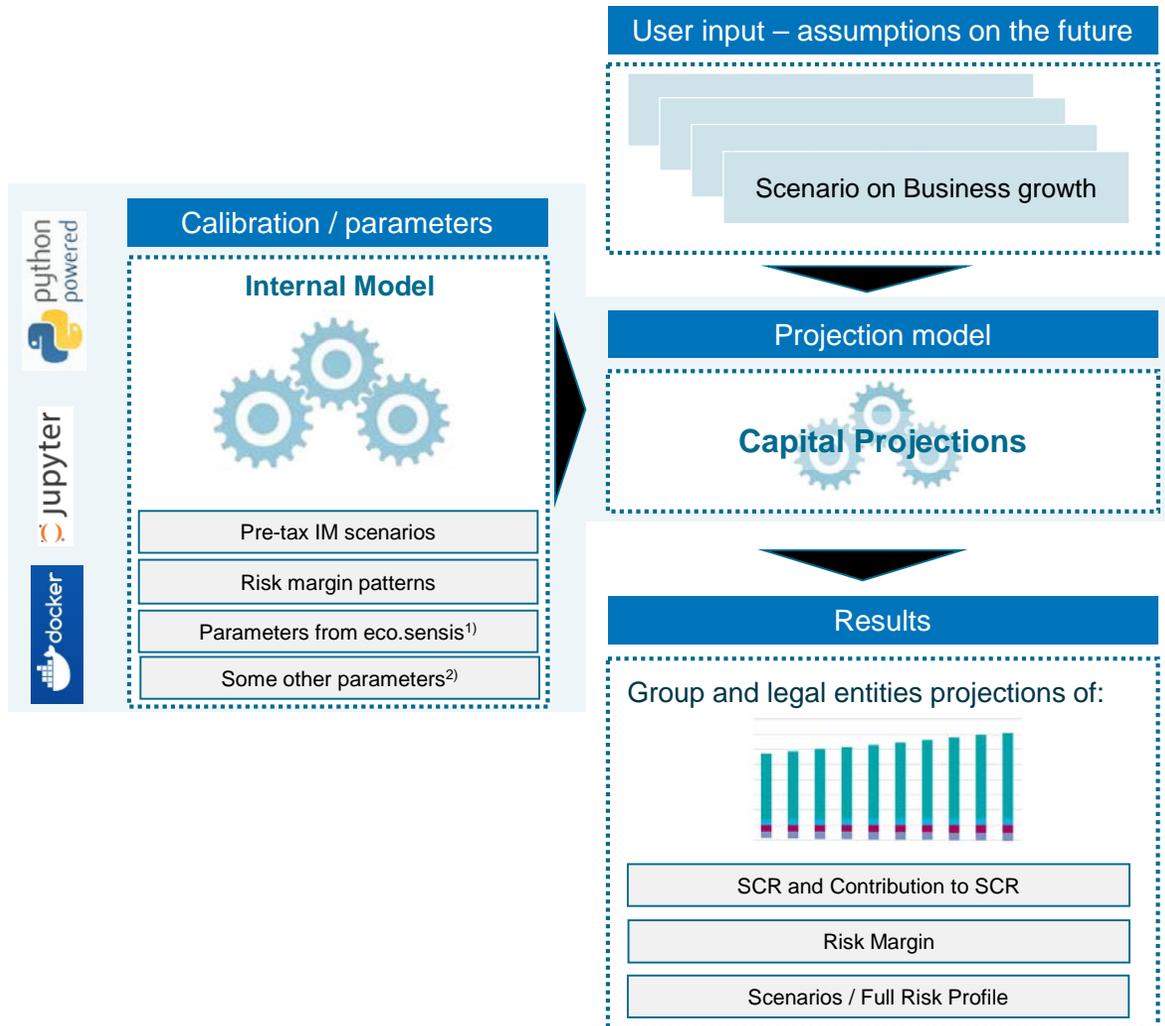
Simple approaches for projection of non-core risks

In addition to UW, all other risks are considered to ensure the projected risk profile is complete:

- **Invested Assets:**
 - **Market value of next year** is calculated as market value of previous year plus expected change in economic value minus expected dividend
 - Planned **asset allocation** is an input into the projections
 - Asset risk scenarios of the first year are scaled accordingly to reflect the risk for future years
- **Operational** and **credit risks** evolve as the 1-in-200 year event of UW risk, through scenario scaling
- **Interest rate** and **currency risks** are kept constant over the projection horizon
- **Tax effects** are calculated on projected pre-tax scenarios



Integrating capital projection into the IM framework has many advantages



Efficient, consistent and convenient

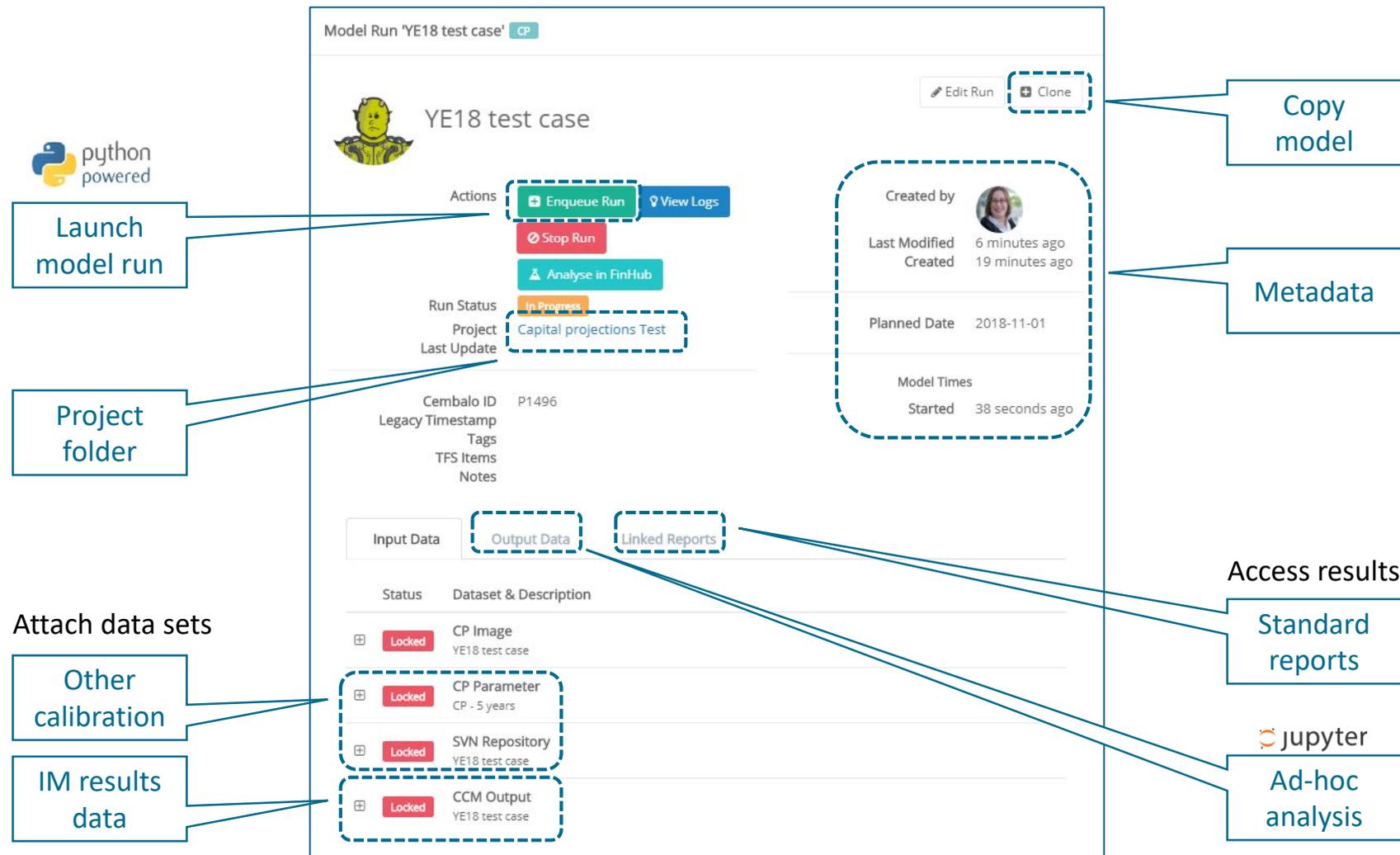
The capital projection module is integrated within the internal model (IM) architecture. Advantages are:

- **Direct access** to IM data inputs/parameters for calibration
- Inputs, modules and methodologies are **consistent**
- Results are available on the **same reporting platform** as the IM
- **Operationally efficient**, leveraging from flexibility designed into the IM
- Efficient **use of development resources** as code is maintained and run in the same environment
- **Model changes** improve both the IM and the capital projection model

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How this looks like in reality – set up and control through a web interface

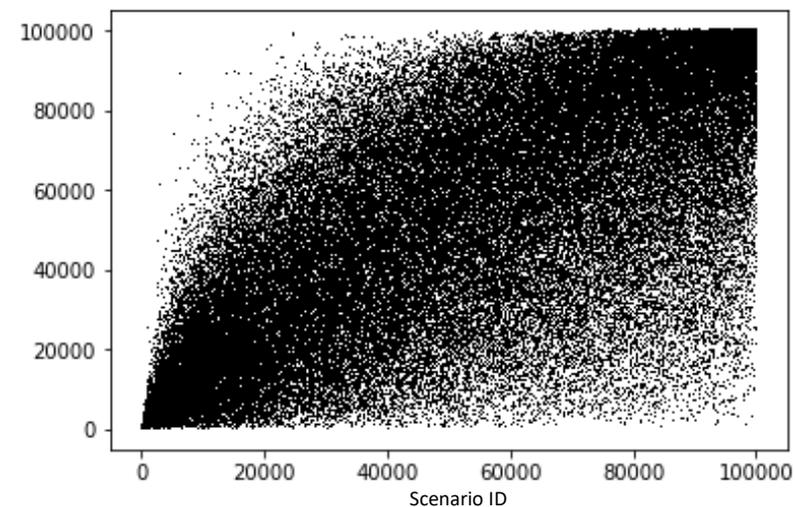


How this looks like in reality – flexible reporting functionalities

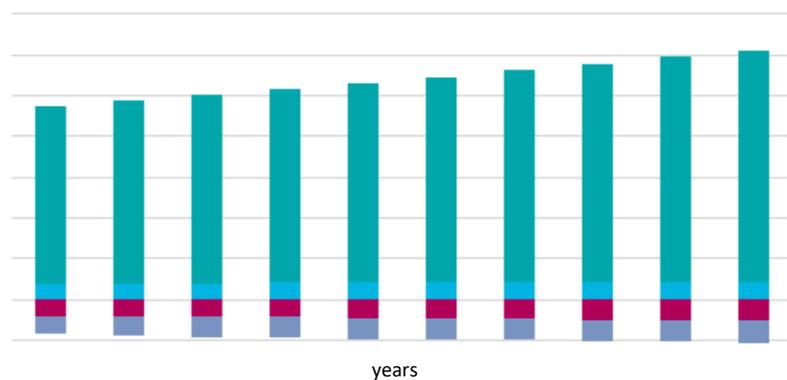
Python code for tailor-made graphs and statistics...

```
def plot_projection_statistic_stacked_by_lob_one_graph(df, statistic_string_for_title,
    lobs = df.T.columns.get_level_values('lob').unique()
    old_fig_size = plt.rcParams["figure.figsize"]
    new_fig_size = (12, 6*len(lobs))
    plt.rcParams["figure.figsize"] = new_fig_size
    fig, axarr = plt.subplots(len(lobs),1)
    try:
        for lob in lobs:
            subplotrow = lobs.values.tolist().index(lob)
            df_xs(lob,level='lob').unstack('layer').sort_index(axis=1, level=0,
                ascending=False).plot(kind=
            axarr[subplotrow].set(title=lob+" "+statistic_string_for_title, xlabel=xlab
            axarr[subplotrow].set_ylim([0, y_limit])
            axarr[subplotrow].grid(True)
            axarr[subplotrow].legend(bbox_to_anchor=(1.15, 1.05))
    finally:
        plt.rcParams["figure.figsize"] = old_fig_size
        fig.savefig(filename)
```

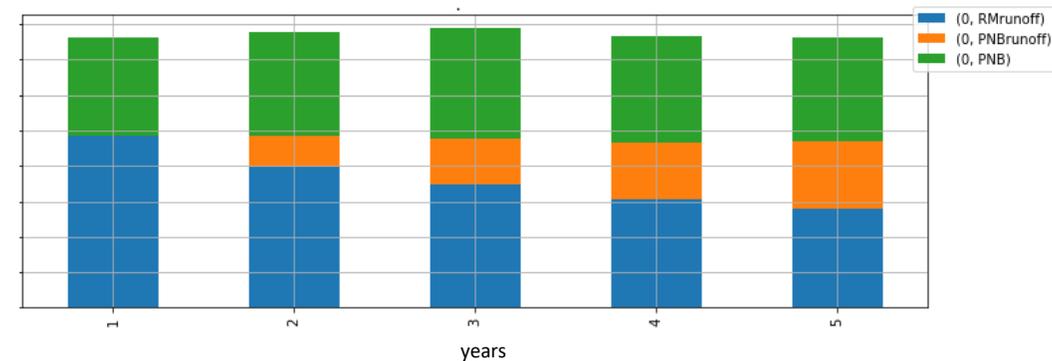
... e.g. dependency scatter plot ...



... or contribution to SCR by risk categories or legal entities...



... as well as details on new business generation



Conclusions ... and next challenges

- Projecting capital requirements beyond one year is needed both for internal and external stakeholders
- Various methodologies can fulfill this purpose, characterized by different level of complexity and precision
- We propose an approach built on the internal model framework and on SCR and RM in particular
- The RM contains information about run-off capitals, while the plan contains a view on the targeted future new business
- This integrated approach offers a series of benefits, in terms of efficiency, consistency and convenience

- ... What is next?
 - An healthy internal model (IM) is a living tool, it always needs to be maintained and kept up-to-date, both in terms of technical implementation and modelling methodology/assumptions. Consequently, the same is true for a capital projection model built on the IM
 - Provide management with an app for mobile devices to e.g. evaluate different growth scenarios together with pre-defined set of economic assumptions
 - Present and discuss the proposed approach within peers / actuarial community and consider enhancements to methodology



Thank you for your attention !



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