**Risk Factors**

**Chosen Factors:**

1. Yield on high-quality corporate bonds
2. Interest rates
3. Inflation
4. GDP growth
5. Risk free rate
6. Mortality

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| **Chosen Factors:** | **Data source:** |
| 1. Yield on high-quality corporate bonds |  |
| 1. Interest rates | <https://www.bankofengland.co.uk/inflation-report/2019/august-2019/visual-summary> or  <https://www.bankofengland.co.uk/boeapps/database/index.asp?Travel=NIxIRx&levels=2&XNotes=Y&A4051XNode4051.x=6&A4051XNode4051.y=17&Nodes=&SectionRequired=I&HideNums=-1&ExtraInfo=true#BM> |
| 1. Inflation | <https://www.bankofengland.co.uk/inflation-report/2019/august-2019/visual-summary> |
| 1. GDP growth | <https://www.bankofengland.co.uk/statistics/gdp-real-time-database> |
| 1. Risk free rate | UK Gilts: <https://www.bankofengland.co.uk/statistics/yield-curves> |
| 1. Mortality | <https://www.ons.gov.uk/peoplepopulationandcommunity/populationandmigration/populationestimates/datasets/vitalstatisticspopulationandhealthreferencetables> |

**Initial note:** I think the Equity release mortgages pose a significant risk and is one which includes significant correlation between inflation, interest, risk free and mortality. I have found some documentation on it but I was wondering if we could get some help on how to model this. Since it is a growing asset help by large insurers like AVIVA and Total Equity Release Lending Activity as more than doubled in the past five years and because these are rather illiquid an unrated assets. My understanding is that we can model these by under stochastic models which allow for a more sophisticated approach to be adopted with, for example, correlations between interest rates and property prices, interest rates, and early terminations.

**Risk factor choice motivation:**

* **Pension Scheme Risk:**
  + Where pension schemes are valued on the Solvency II balance sheet under IAS19, insurers use the yield on high-quality corporate bonds for the valuation of the liabilities. This may differ from the yield on assets actually held by the scheme.
* So the **yield on high-quality corporate bonds** is a risk factor
  + These are influenced by **interest rates**, **inflation** and **GDP growth**

**Note:**

For all participants for which it is relevant assumed a medium or high positive correlation between credit spread and equity risks. The assumptions are broadly consistent with the Standard Formula’s prescribed high positive correlation (+75%).

* **Equity release mortgages**
  + Illiquid unrated assets such as equity release mortgages (ERM) have been increasingly used by life insurers with large annuity books in recent years to optimise their capital position under Solvency II. As of July 2017 it was noted that 25% of annuity liabilities were backed by illiquid direct investment assets with the Prudential Regulation Authority (PRA) expecting this to increase to 40% by 2020.
* Property growth: we can model the best estimate property growth assumption in one of two ways – either using a **risk-free rate** or as a margin over Retail Price Index(RPI) or the RPI swap curve, with the margin ranging from 0.5% to 2%.
* Those using a risk-free rate apply a stress in line with the interest rate calibration. The other participants apply a reduction to the assumed best estimate growth rate, ranging between about 1.25% p.a. and 2.60% p.a. .
  + In short, we need to model inflation
  + Those using the risk free rate that will be stressed in line with interest rates, I believe it means that we need to model the interest rate under macroeconomic factors. So I think we need to generate forecasts for the dynamic paths of macroeconomic factors such as GDP, money rates, and government yields under different scenarios. Along with those for the interest rates we can estimate them jointly in a vector autoregressive system.

**A note on interest rates:**

Insurers have begun making an allowance for interest rates to fall below 0% in their interest rate stress calibration. Nearly half of participants surveyed said they applied a floor, with a variety of approaches to implementing this in practice, including a fixed floor, a shifted log-normal model or a floor based on the largest historical negative rates observed. Where a floor is not applied, most participants observe negative interest rate scenarios at the medium and long term within their models.

* **Mortality**
  + **Mortality** risk, as defined by Solvency II, is the risk of loss, or of adverse change in the value of insurance liabilities, resulting from changes in the level, trend or volatility of mortality rates, where an increase in the mortality rate leads to an increase in the value of insurance liabilities. It affects predominantly protection contracts, such as term assurance.
    - Longevity risk, as defined by Solvency II, is the risk of loss, or of adverse change in the value of insurance liabilities, resulting from changes in the level, trend or volatility of mortality rates, where a decrease in the mortality rates leads to an increase in the value of the insurance liabilities. Longevity risk affects contracts where benefits depend on the likelihood of survival

**Note:**

Aviva’s most material risk changed from market to non-life underwriting. This followed a slight reduction in the level of market risk whilst non-life underwriting risk is broadly unchanged since last year.

* + Non-life indicates general insurance
  + General liability insurers, in aggregate, hold a greater proportion of their investments in government and corporate bonds than property insurers (78% versus 33%). This may reflect the longer-tailed nature of the liabilities of general liability insurers, compared to property insurers, meaning longer duration assets are required