Complex Reality, Complex Models?

James Norman
Simple vs Complex Models

- **Economics**
  - ARIMA vs. Large Scale Macroeconomic Models

- **Asset Allocation**
  - 1/N vs. Markowitz Portfolios

- **Seismology**
  - Guttenberg-Richter vs. Characteristic Earthquake Model

- **FX Rates**
  - Random Walk vs. Monetary Models

- **Banking**
  - Leverage Ratio vs. Risk Weighted Capital

- **Demographics**
  - Extrapolation vs. Census Bureau Model

Complex models have often performed poorly compared to simpler models
What is a Complex Model?

Complex
Many parts

Vs.

Complicated
Difficult to understand
Balancing Simplicity and Complexity

Structural Error – Model structure does not reflect reality
Parameter Error – Model parameters not estimated correctly
Other Considerations

Greater clarity
Easier to test
More robust
Faster answers
Less work to operate
Multiple models?

Simple

Complex

One model for all purposes
Business buy-in
More detail
More insight?
Higher risk sensitivity?
More assumptions
Complexity in Banking Internal Models

“With thousands of parameters calibrated from short samples, these models are unlikely to be robust for many decades, perhaps centuries, to come. It is close to impossible to tell whether results from them are prudent.”

“The Dog and The Frisbee”, Andrew G Haldane, Executive Director, Financial Stability and member of the Financial Policy Committee and Vasileios Madouros, Economist, Bank of England
# Complexity in GI Capital Models

<table>
<thead>
<tr>
<th>Risk Area</th>
<th>Number of Parameters (Approx)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Non-Cat Underwriting Risk</td>
<td>300</td>
</tr>
<tr>
<td>Cat Underwriting Risk</td>
<td>??</td>
</tr>
<tr>
<td>Reserve Risk</td>
<td>1,000</td>
</tr>
<tr>
<td>Credit Risk</td>
<td>50</td>
</tr>
<tr>
<td>Market Risk</td>
<td>1,000</td>
</tr>
<tr>
<td>Op Risk</td>
<td>500</td>
</tr>
<tr>
<td>Dependencies</td>
<td>1,000</td>
</tr>
<tr>
<td>SII Balance Sheet</td>
<td>2,000</td>
</tr>
<tr>
<td><strong>Total (excl Cat)</strong></td>
<td><strong>5,850</strong></td>
</tr>
</tbody>
</table>

Based on relatively common GI capital model methodologies, assuming:
- 30 lines of business
- 3 currencies
- 10 prior years
- 30 op risks
- etc
Where Are We Now?

![Graph showing the relationship between prediction error and complexity, with lines representing structural error, parameter error, and total error. The graph indicates a decrease in error as complexity increases, with a question mark suggesting a point of uncertainty or concern.]
Possible Areas for Simplification

- Stochastic cashflows
- Detailed inflation models
- Granular operational risk models
- Clash modelling
- PPOs?
- Big correlation matrices
- Stochastic expense models (not just ulae)
- Stochastic emergence patterns
- Detailed models of IBNER and IBNR
- Risk Margin
- Granularity
- Modelling every reinsurance feature
- Detailed modelling of management actions
- Stochastic elasticity models – rates vs volumes
Getting the Right Balance

- Be aware of complexity
- Think more “top-down”
- Start simple by default
- Consider parameter uncertainty
- Try simple models alongside complex ones
- Simplifying (well) is hard

“Simplicity is the ultimate sophistication”

Leonardo Da Vinci
Expressions of individual views by members of the Institute and Faculty of Actuaries and its staff are encouraged.

The views expressed in this presentation are those of the presenter.