Institute and Faculty of Actuaries

Model Review: A Case Study

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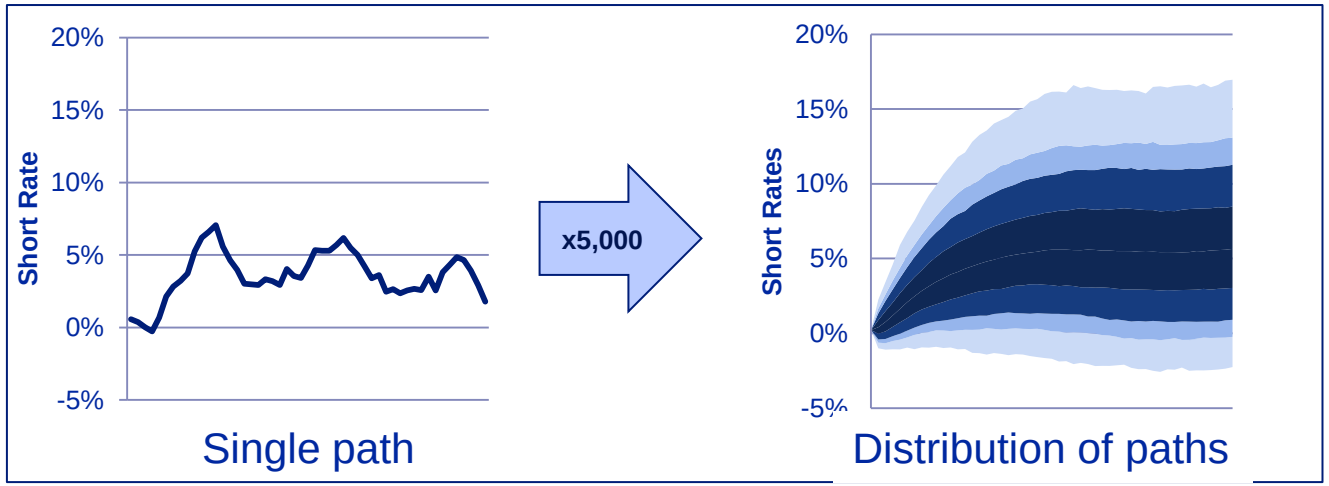
Agenda

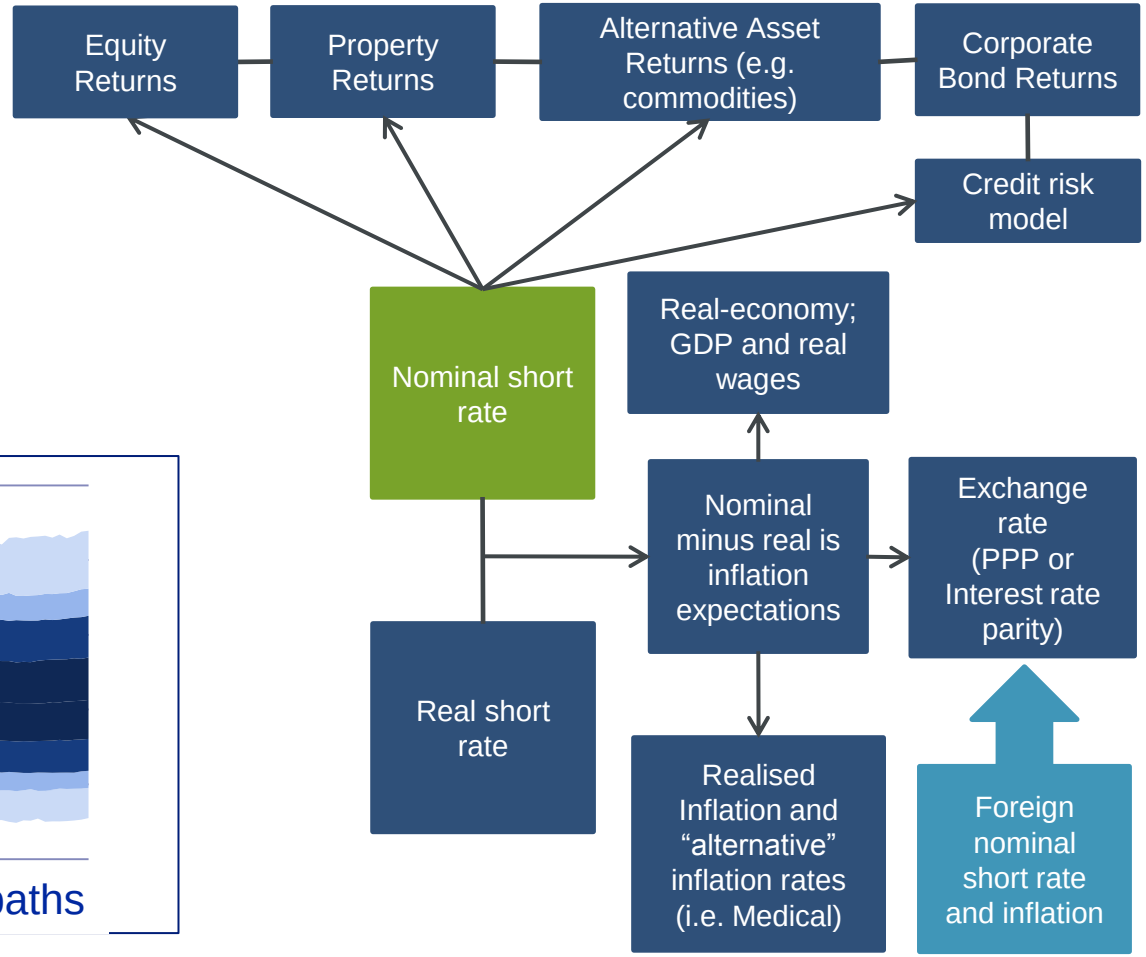
- Introduction.
- What is Model Validation?
- Example: Credit Models in 2007.
- Responding to Model Validation.
- Summary.

Economic Scenario Generator (ESG)

- Uses Monte Carlo simulation to generate 1000s of different paths of an economy by stochastically modelling many different economic risk drivers
  - Interest rates, equity returns, corporate bond returns
- A simulation is a collection of many paths (trials)



Short rate – interest rate that applies over a very small period of time.



What is Model Validation?

There are many ways to judge a model:

- Mathematic Soundness: no arbitrage, internal consistency, economic theory.
  - Need to understand underlying assumptions
- Against other models and market best practice.
- Back-testing and validating results against actual data.
- Practical considerations, flexibility, extensibility and business value.
  - Model limitations vs. use case.

What do we look for in a Credit Spread Model?

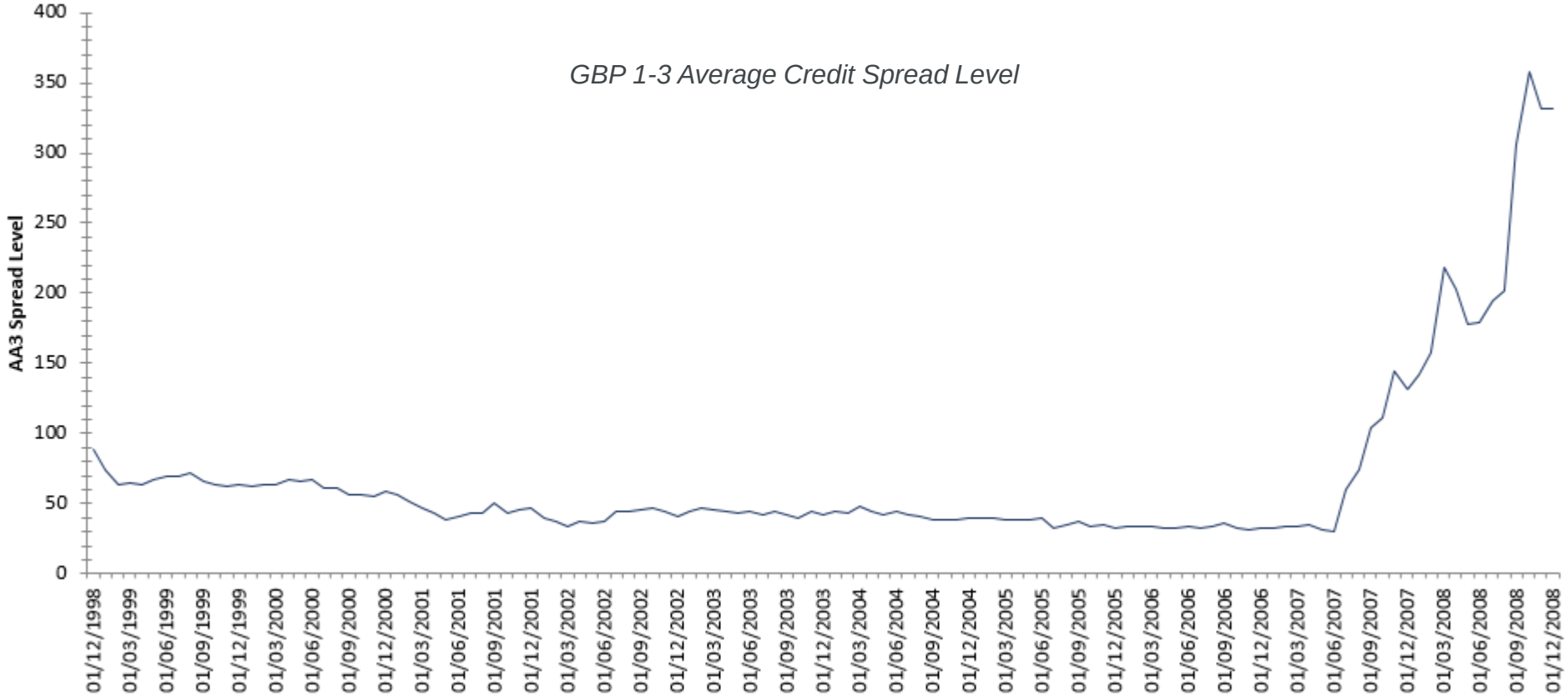
Some of the questions we ask when reviewing a credit spread model:

- What are the spread dynamics?
  - Are the spreads positive, mean reverting spreads that increase with rating?
  - Is the size of spread movement proportional to spread level?
  - Are the Spreads of different ratings are highly, but not perfectly correlated?
- What are the default/transitions projection dynamics?
- What other models do we have access to?
- How well do the model results validate?
  - What's the fit to initial spreads?
  - What's the fit to spread distributional assumptions?
- Is the model appropriate for its use case?
- Is the model parsimonious, easy to explain and calibrate?

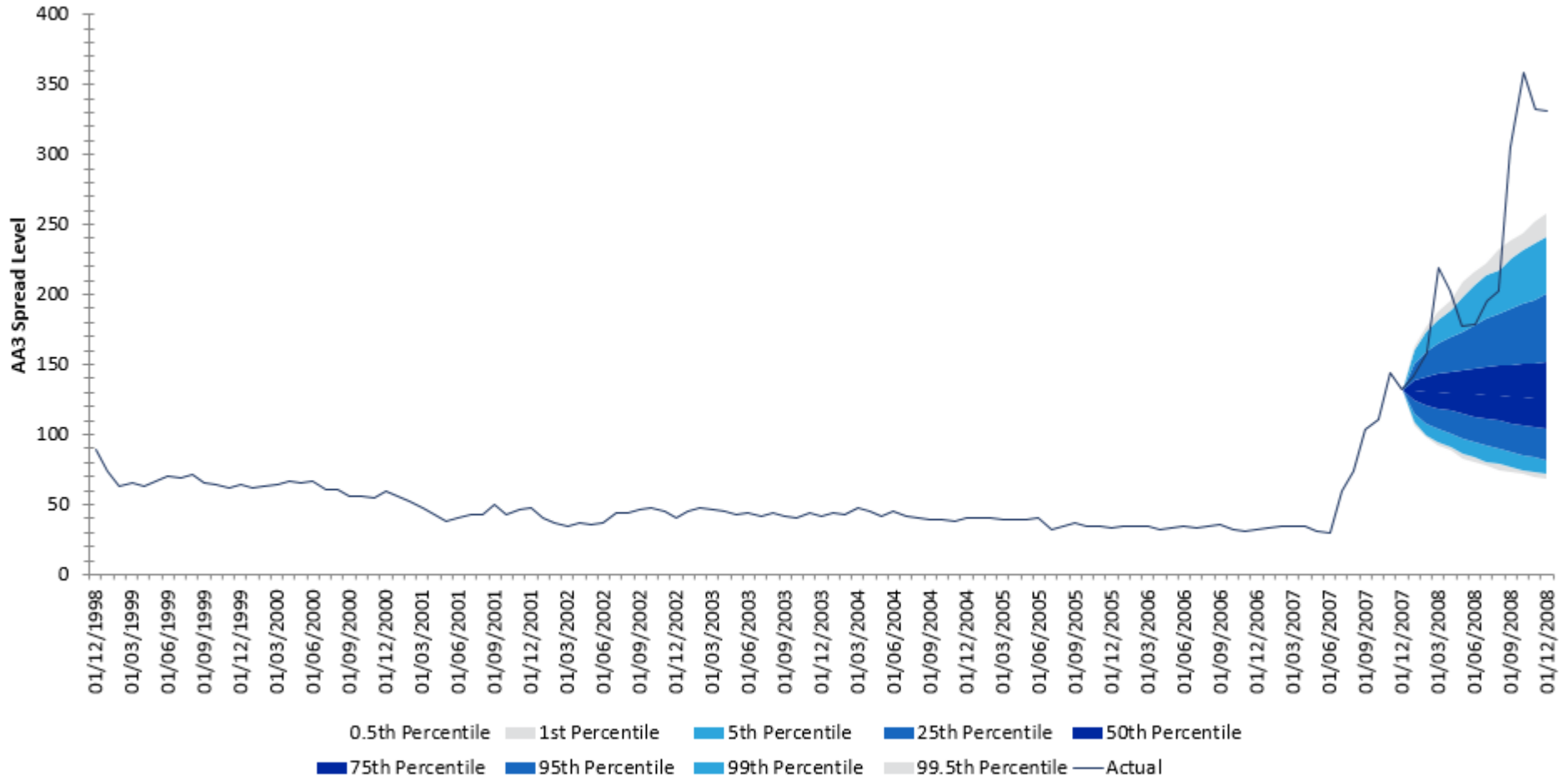
Credit Spreads from 2007

Pre 2007 most of the credit model projections were used to model long term business run-off.

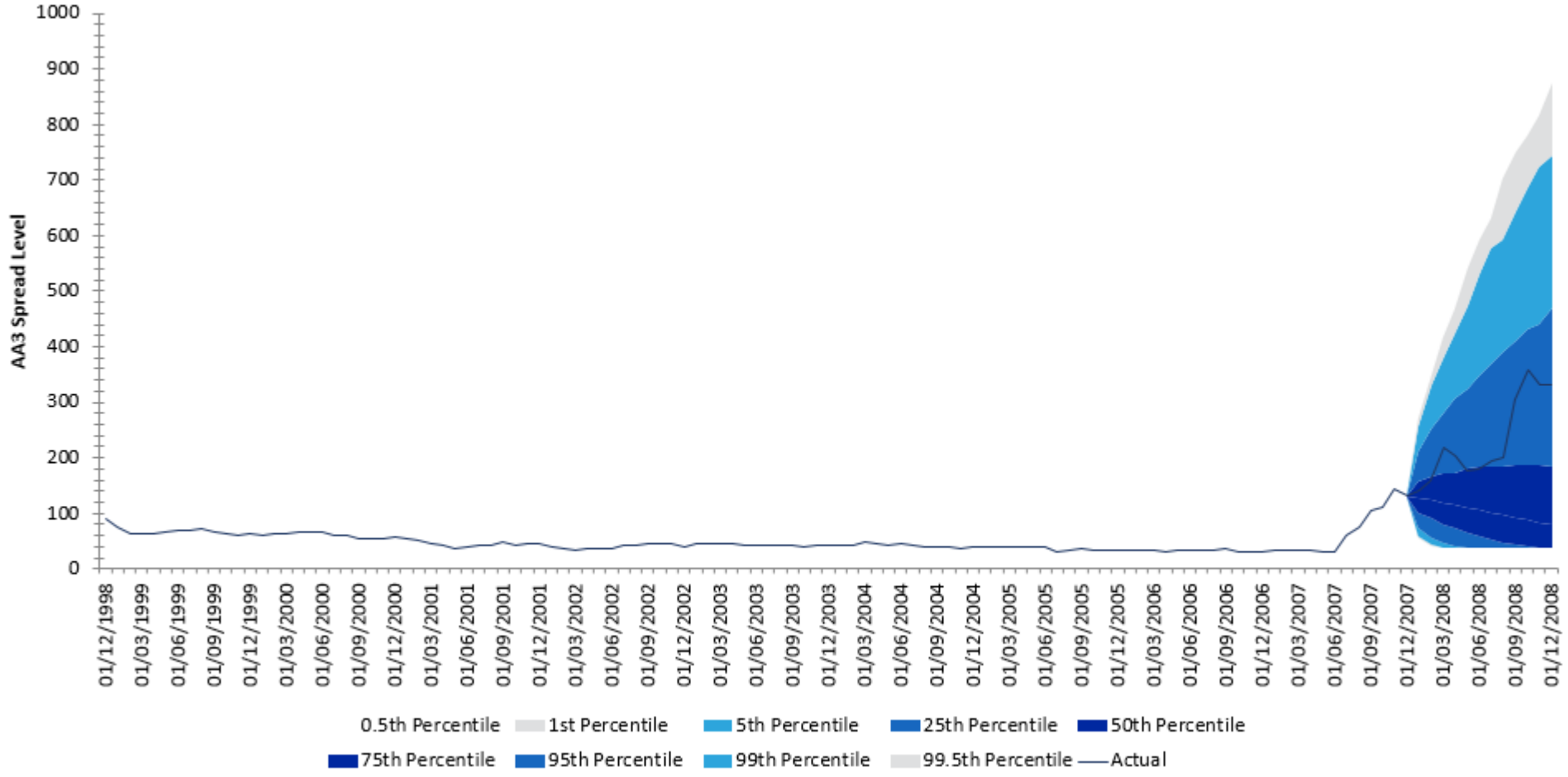
We were confident that our model was appropriate. **So how did we do in 2007?**



Validation in 2007-2008



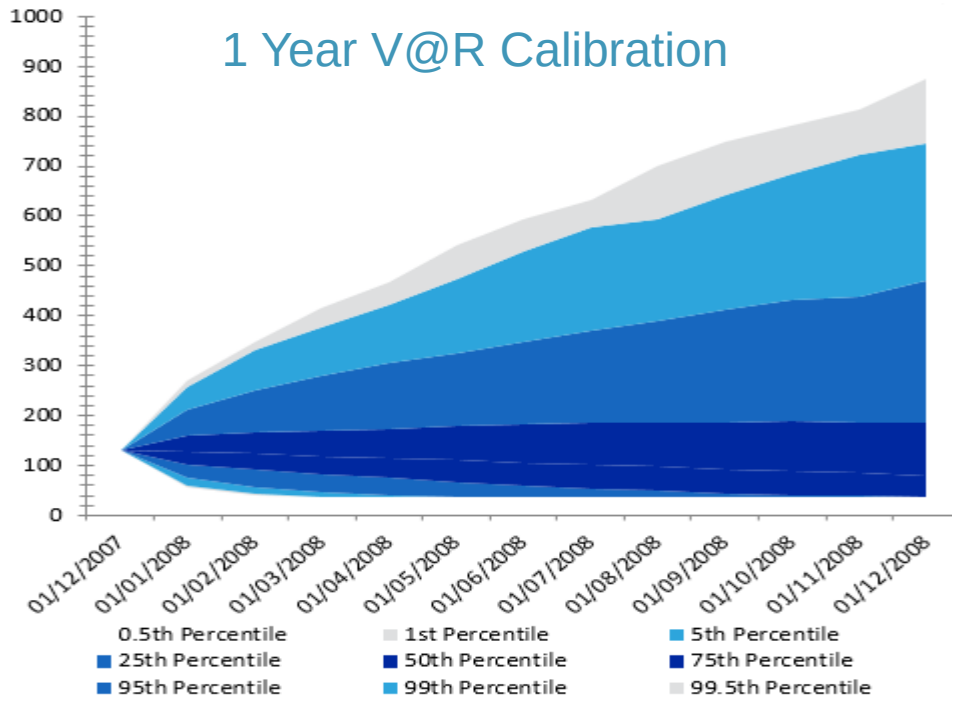
We made some improvements: Introducing 1 Year VAR

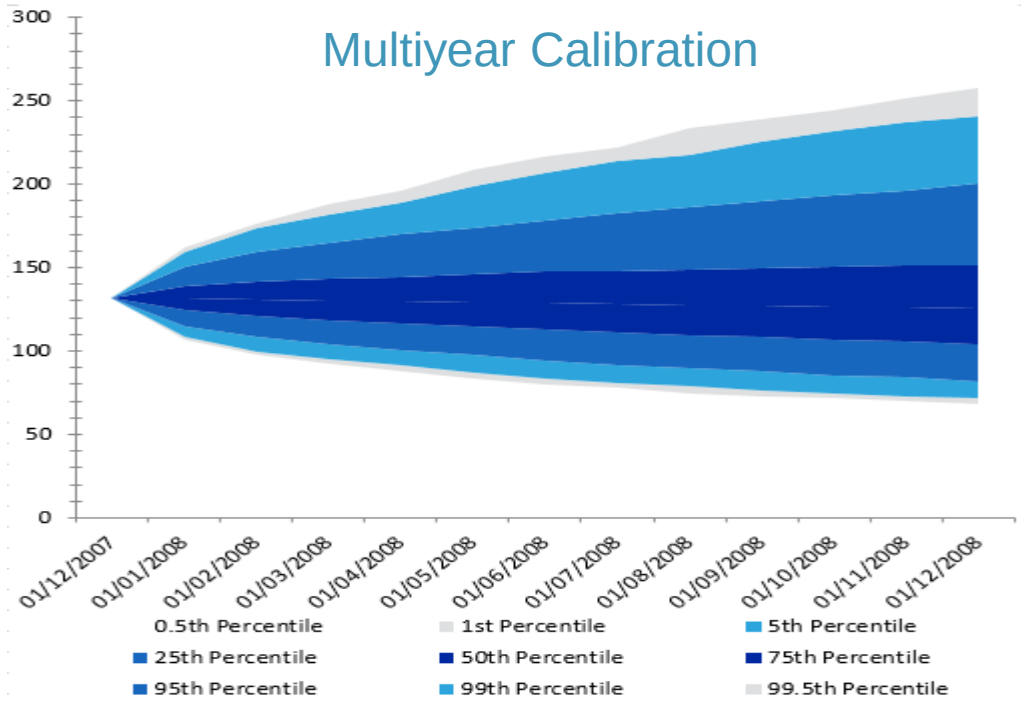


Responding to Model Validation

We came across an issue and we solved it by introducing a second calibration service for the same model (G2). So for capital projections we offered a 1 Year VaR (conditional) calibration and for multiyear purposes (e.g. Investment Strategy) we offered our Multiyear / Best Views (unconditional) calibration.

So should we pat ourselves on the back?





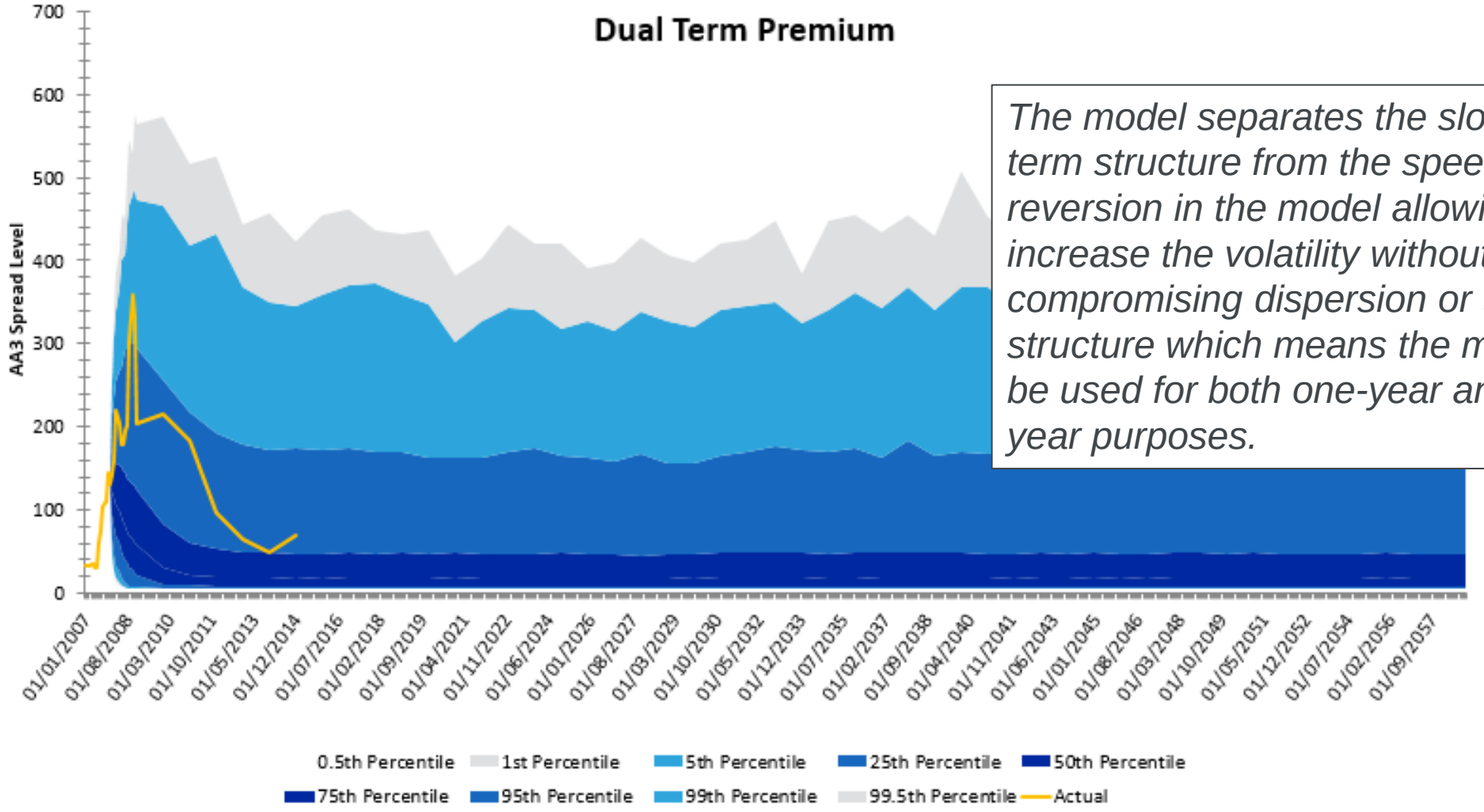
What did we learn?

1 Year V@R Calibration	Multiyear Calibration
Good Mean paths ✓	Good Mean paths ✓
Dispersion of spread levels over 10 years is too wide ✘	Sensible dispersion of spread levels over 10 years ✓
The volatility of spreads over 1 year is capturing the risk. ✓	The volatility of spreads over 1 year is not capturing all the risk. ✘

However, we felt we could do better and so went back to the maths.

By introducing a risk premium which is dependent on the level of the spread we created what we call the ‘Dual Term Premium’ G2 Model.

Back testing with Dual Term Premium



The model separates the slope of the term structure from the speed of mean reversion in the model allowing us to increase the volatility without compromising dispersion or the term structure which means the model can be used for both one-year and multi-year purposes.

Summary

No model is perfect

- Even if you think you have a good model today, it doesn't mean it will be appropriate tomorrow.
- The mathematics and financial theory keeps evolving, so should the models we use.
- Understanding the weaknesses of your current models is paramount!

Markets change

- The markets shift and change, so the models need to be assessed against new conditions.
- The validity of underlying assumptions and forecasts needs to be frequently reviewed.
- Scenario testing (calibrating to a number of alternative assumptions) can aid in understanding of your results.

Model validation matters

- Model validation shouldn't be an afterthought but a constant proactive review of model and assumptions.
- This requires suitable resources in place, which means cost. But what's the cost of not doing it?

Be practical

- These are not simple problems to solve. Sometimes a practical solution is necessary, but having one should not stop you from looking for a better solution!