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# The Evolution of Economic Scenario Generation

Bill Curry and Gabi Baumgartner



28 November 2014

## Agenda

- Where it all began
- What the market demands
- Regulatory and market challenges
- Where we are today
- What the future may hold

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2

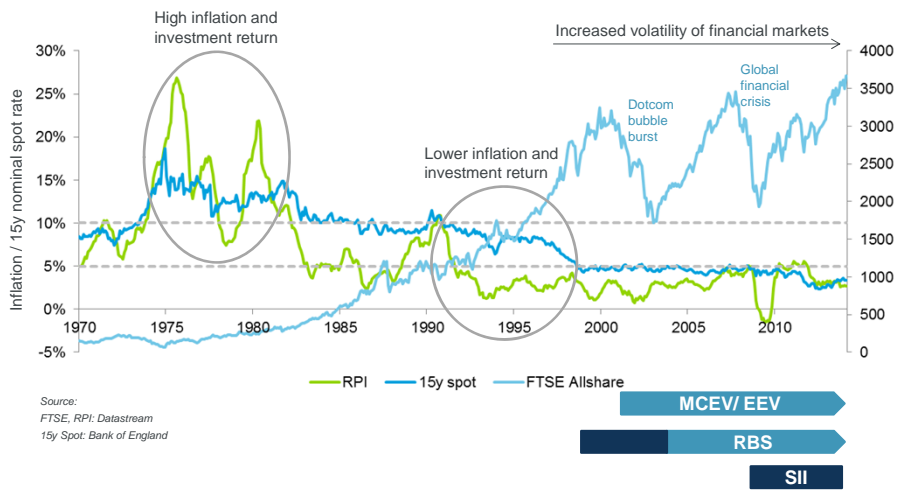


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## Where it all began



## Where it all began Market consistent valuation - TVOG



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4



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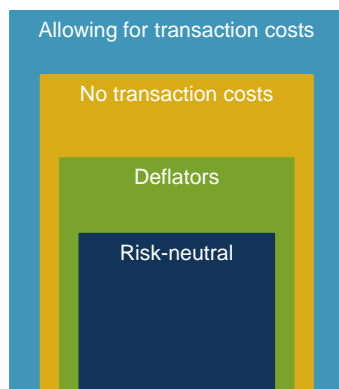
## What the market demands



## What the market demands

Definitions and uses of ESGs

### Shades of arbitrage-free



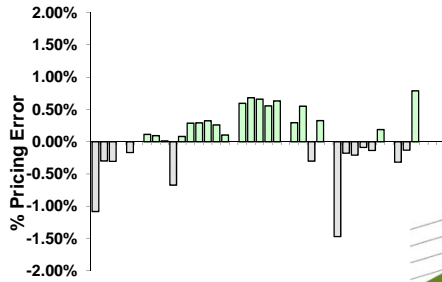
### Calibration approach



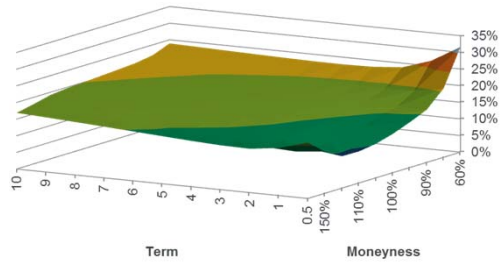
## What the market demands

### Market-consistency and ESG calibration

Fit to market prices...



...in all dimensions

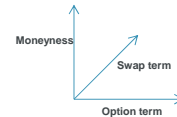


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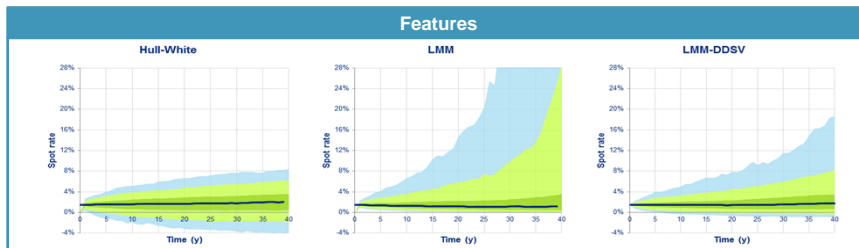
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## What the market demands

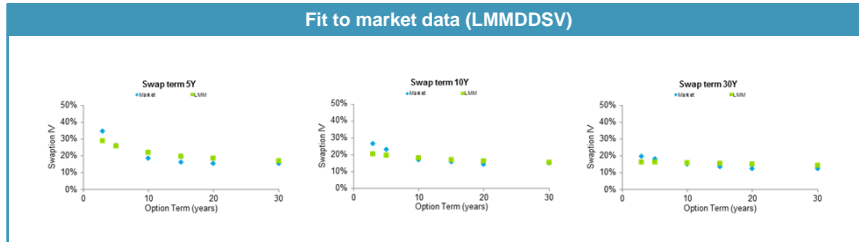
### Interest rates



Features

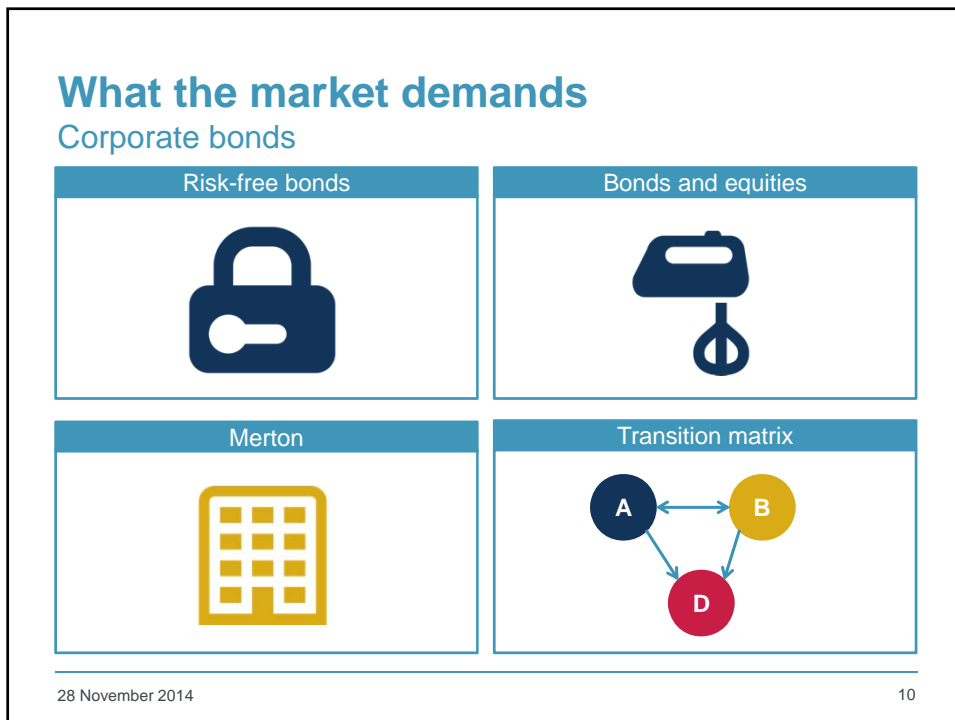
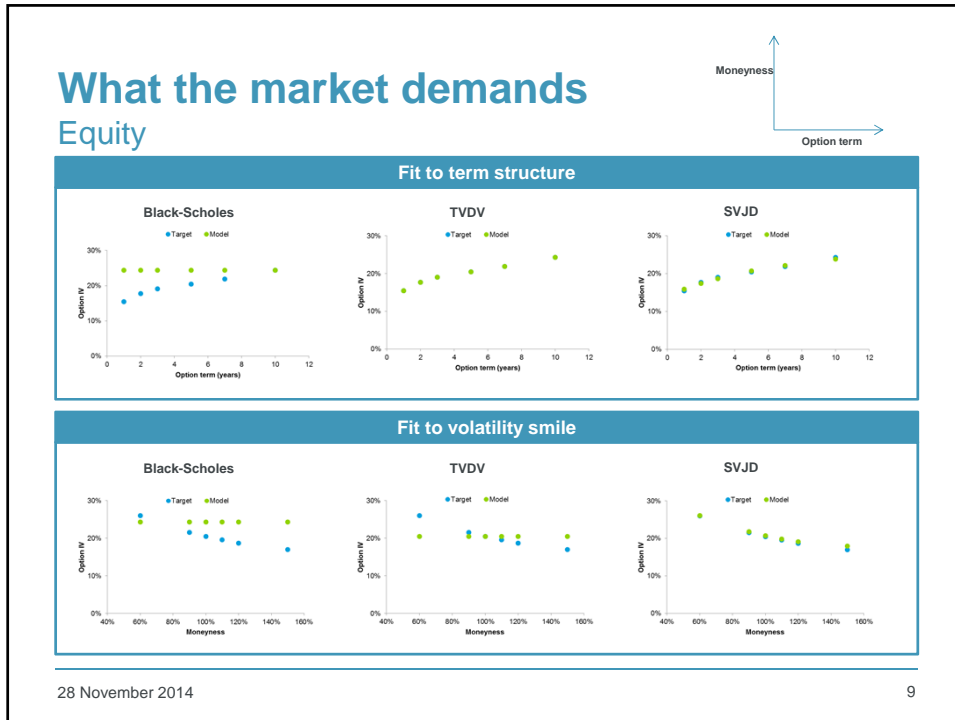


Fit to market data (LMMDDSV)



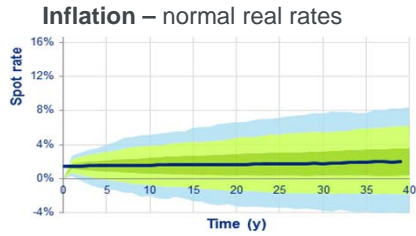
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8

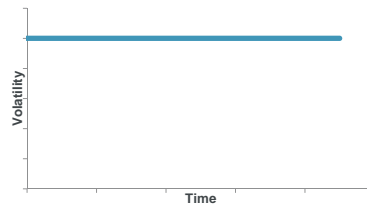


## What the market demands

### Inflation and property



### Property – constant volatility



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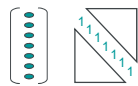
11

## What the market demands

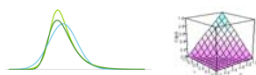
### Capital

#### Market + non-market risks

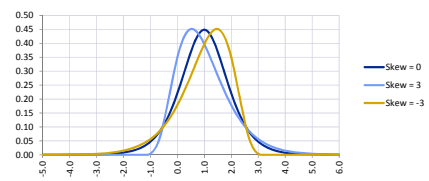
Stress testing and correlations  
normal distribution



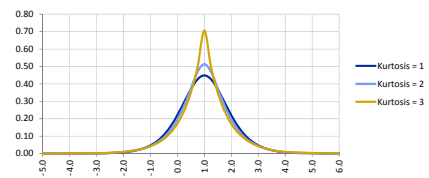
Full Monte-Carlo  
skew and fat tails



#### Skewness



#### Kurtosis

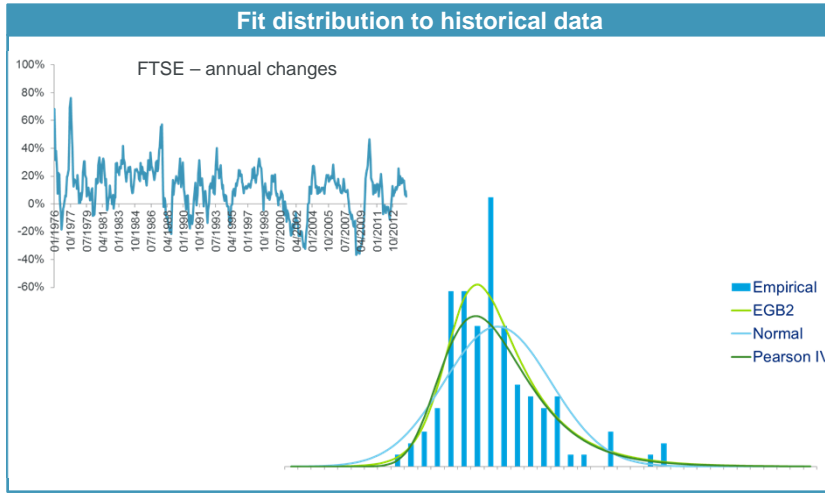


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12

## What the market demands

### 1y VaR scenario calibration

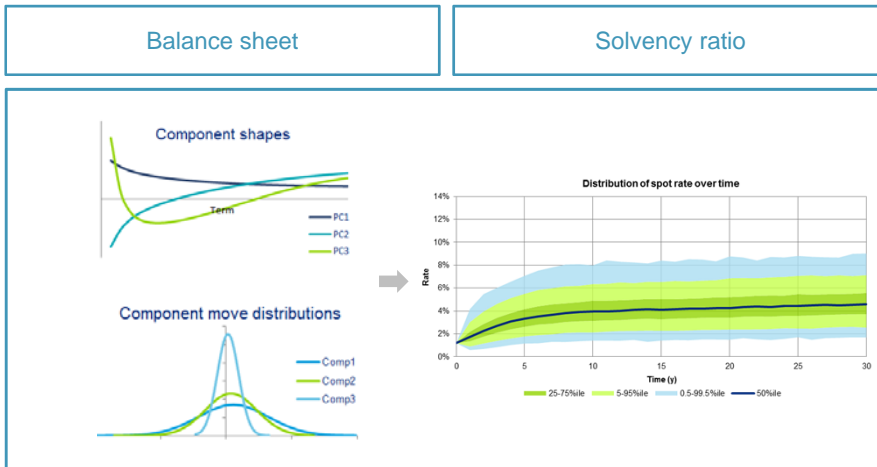


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13

## What the market demands

### Projections

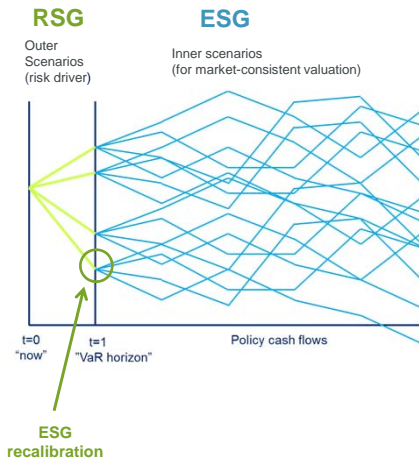


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14

## What the market demands

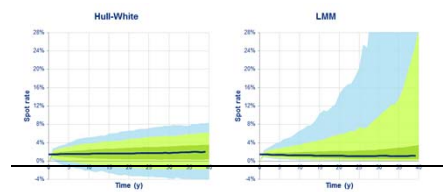
### Nested stochastic



### The recalibration problem

Driven by model choice

	RSG	ESG	Challenge
#1	ESG latent parameters	No recalibration	How to set RSG distributions?
#2	Observable risk drivers	Recalibration	How to efficiently recalibrate?
#3	Observable risk drivers	ESG shifting/flexing	How to allow for volatility risk?

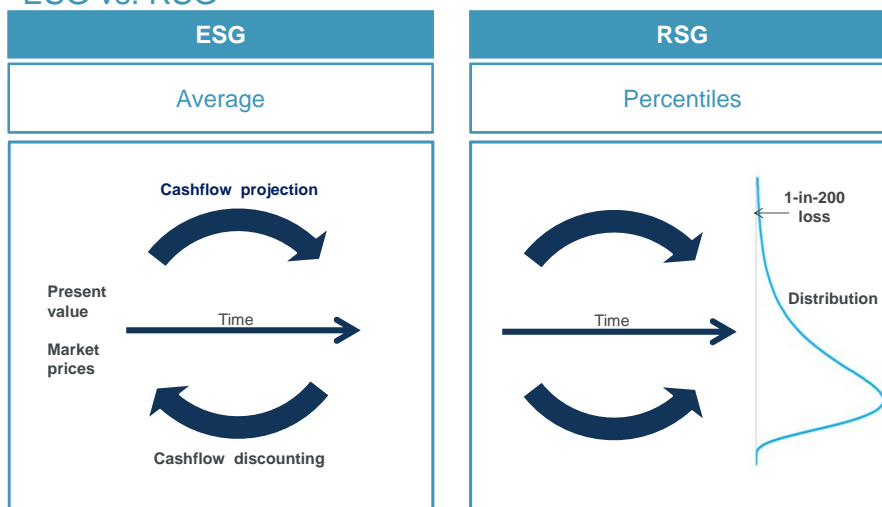


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15

## What the market demands

### ESG vs. RSG



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16



## What the market demands

### A summary

#### RSG

- Risk scenarios
- Market and non-market risks
- Wide choice of distributions
- Dependency structures
- Statistical calibration

#### ESG

- Market-consistent scenarios
- Valuing guarantees
- Arbitrage-free
- Fit market prices

#### RSG + ESG

- Proxy fitting scenarios
- Nested market consistent scenarios
- Fitting replicating portfolios or curves

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17



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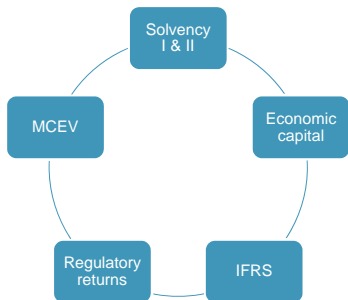
## Regulatory and market challenges



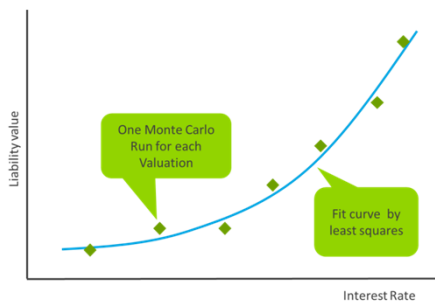
## Regulatory and market challenges

Lots to calculate - AUTOMATION

### Multiple bases



### Large number of heavy runs



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19

## Regulatory and market challenges

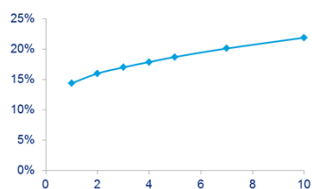
Demonstrating ownership of assumptions and models

### Documentation

- Complete
- Clear
- Easy to follow



### Key judgments



### Analyses performed



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20

## Regulatory Challenges

### Understanding the model

- Model choice
- Interaction within the ESG?
- What are the limitations?
- Validation
- The use test

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21

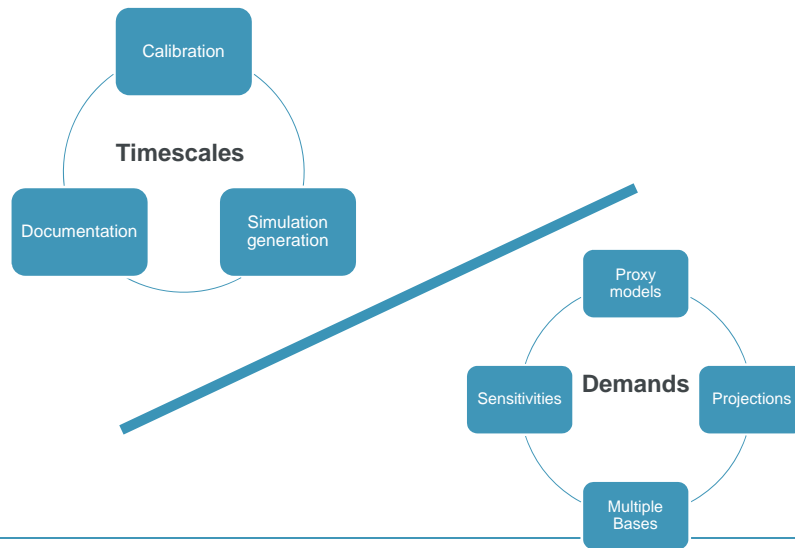


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## Practical challenges



## Practical Challenges

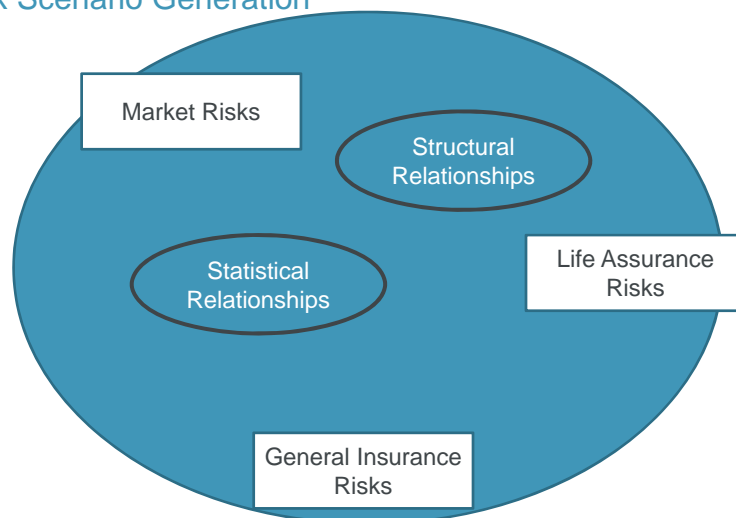


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23

## Practical Challenges

### Risk Scenario Generation

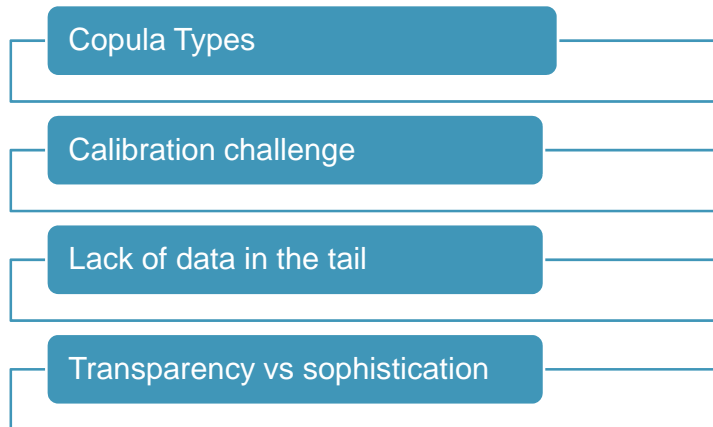


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24

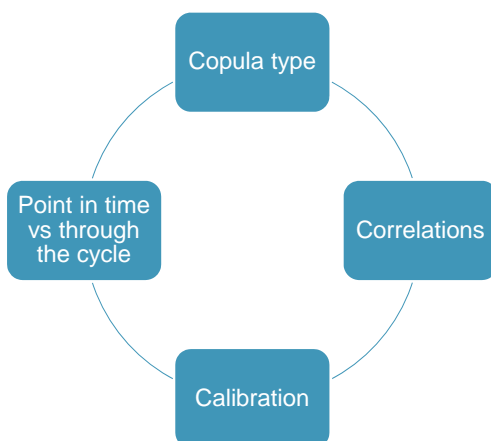
## Practical Challenges

### Risk Scenario Generator - Copula



## Practical Challenges

### Projections





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## Where we are today



### Where we are today

Sophisticated ESGs and evolving RSGs

Licensing model



Delivery time scales



ESG vs. RSG



Automation



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28



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## What the future may hold



### What the future may hold

More of the same and better

1	Usage	Many purposes
2	Documentation	Lots
3	Justifications	Rigorous
4	Automation	Complete
5	Models	Tailored
6	Technology	Advanced
7	Real-world scenarios	Enhanced

