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ESG Limitations and Developments
Sam Worthington

30 November 2015

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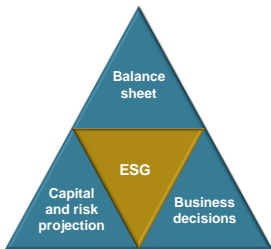
Agenda
- Models
- Calibration
- Assumptions
- Judgement

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ESGs are a key component of internal models

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Real World and Risk Neutral ESGs

ESG

Real World
- Focuses on realism
- Calibration to historical data
- Uses: ORSA, ALM, SAA

Risk Neutral
- Market consistent
- Calibration to today's market prices
- Uses: MCEV, Pricing

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towerswatson.com

4
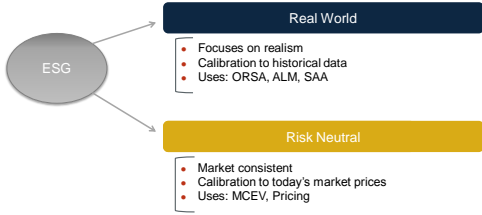
Optimal asset allocation is highly sensitive to model limitations

Modern portfolio theory H. Markowitz 1952

"We are seeing 25σ moves several days in a row" GS&Co 2007

Model

Judgement

Assumptions   **Calibration**

"When genius failed: the rise and fall of LTCM" 1998

"Galloping Gerty" Tacoma Narrows Bridge 1940 "Wobbly bridge" Millennium Bridge 2000

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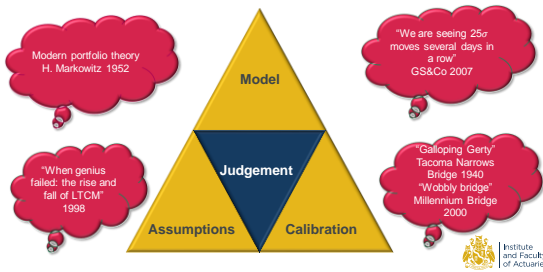
The modeller's challenge

The real world

Required (Validation)   Possible (R&D)

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6

2
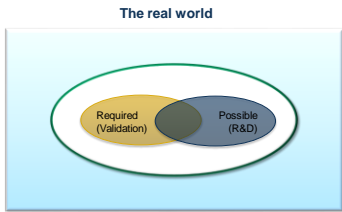
Developing a fit for purpose model

Efficiency

| Too simple | "Just right" | Too complicated |

Model features

Costs of complexity
- Development, calibration, documentation, IT costs, key man risks
- Opportunity costs of slow run times and slow evolution
- Increased frequency and severity of modelling mistakes

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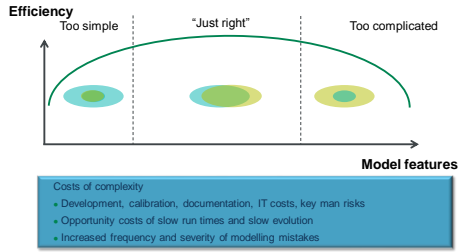
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Limitations of ESGS

Models

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Credit modelling

| Sovereign | Quasi & Foreign Government | Securitized / Collateralized | Municipals | Preferred Securities | Corporate |

Covered
Securitized

Financials
Industrials
Utilities

Pfandbriefe
Non-Pfandbriefe Covered

Asset backed
Collateralized Mortgage Obligation
Commercial Mortgage Backed
Mortgage Backed

Banking
Financial services
Insurance
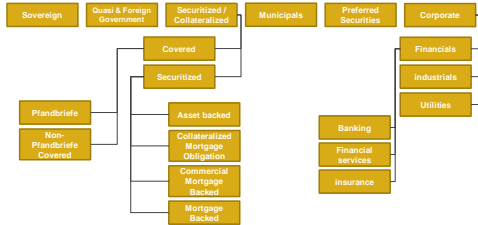
Coverage and risk attribution granularity of credit

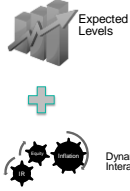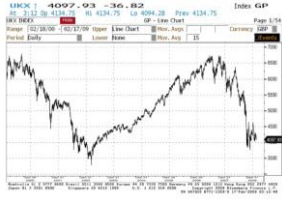Institute
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Capture tail risk

"We've just had a 1 in 1,000 year event happen 3 times last Week"

Expected Levels

Dynamic Interactions

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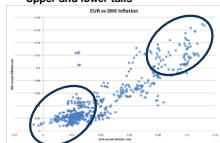
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Tail Dependency: asymmetric, symmetric - or none?

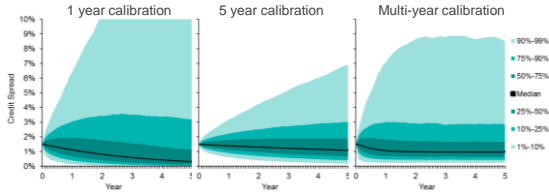**Upper and lower tails**

Only lower tail

Trend or randomness?

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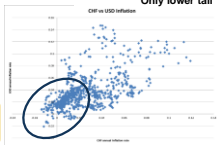
Limitations of ESGs
Calibration

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Multi-year real world ESG calibration

| 1 year calibration | 5 year calibration | Multi-year calibration |

Credit Spread

Demand for calibration that is consistent over 1 year and multi-year
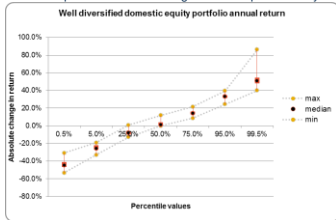
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13

One year real world ESG calibration

• Companies use a wide range of assumptions for 1 year risk distributions

Well diversified domestic equity portfolio annual return

The Towers Watson Internal Model Calibration Survey shows a wide spread of assumptions for one year market risk

• These assumptions affect both capital requirements and the relative attractiveness of different asset classes

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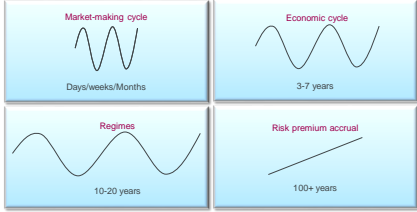
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14

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Limitations of ESGs

Assumptions

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Categorising cycles in markets

Market-making cycle	Economic cycle
Days/weeks/Months	3-7 years
Regimes	Risk premium accrual
10-20 years	100+ years

16

Understanding regimes (1)

US Treasury bond yields

Regime thinking?

Typical model

Naïve extrapolation
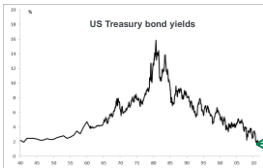
(Sources: Robert Schiller, Bloomberg)

17

Understanding regimes (2)

% of global equity market cap

Unlucky?

Lucky?
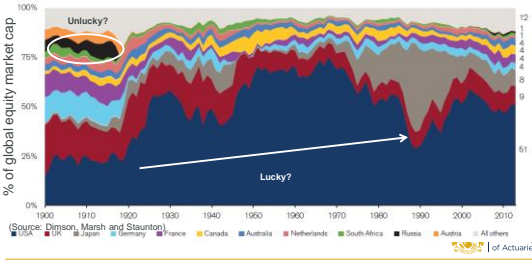
(Source: Dimson, Marsh and Staunton)

USA · UK · Japan · Germany · France · Canada · Australia · Netherlands · South Africa · Russia · Austria · All others

18

6

Finance, not physics!

One asset class/investor | The market | The observer

19

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Managing ESG uncertainty

Judgement

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Dealing with model risk: stresses

Stress testing

Reverse stress testing

95% Events and Contours of Surplus
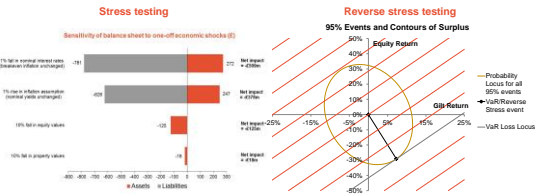
21

Dealing with model risk: scenario testing

Scenarios

Projected accounting surplus/deficit (£m)

Extreme risks

Rank	Risk
1	Depression
2	Sovereign default
3	Hyperinflation
4	Banking crisis
5	Currency crisis
6	Climate change
7	Political crisis
8	Insurance crisis
9	Protectionism
10	Euro break-up
11	Resource scarcity
12	Major war
13	End of fiat money
14	Infrastructure failure
15	Killer pandemic
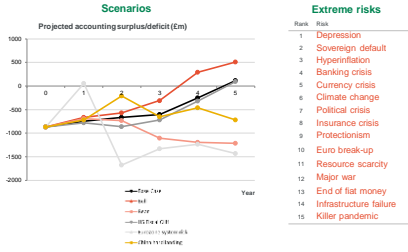
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More needed from your ESG

Better models
- Ensure your model captures latest developments
- Multiple models can help ensure modelling is "fit for purpose"

Better assumptions
- Incorporating short-term economic conditions
- Dealing with long-term regimes

Better interpretation
- Supplement model output with model-independent risk analysis
- Adopt a framework that controls model risk
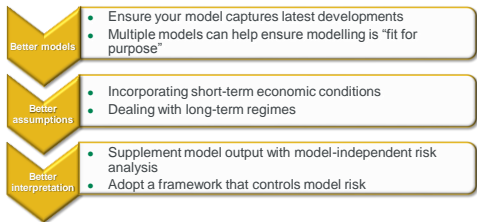
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Questions   Comments

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.

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