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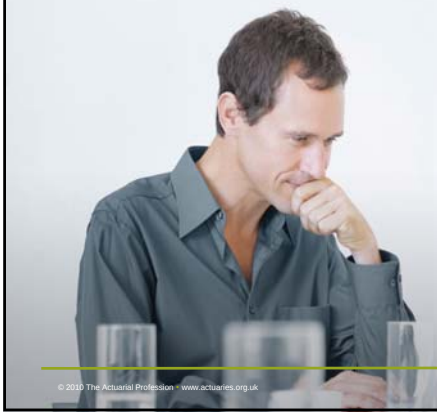

Stable Measures of Risk Capital

20-22 November 2011

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Agenda

Introduction: tail risk in a multi-period context
The purpose of capital and impact of regulation
Regime dependence – Point in Time v. Through the Cycle
Solvency II
Multi-period modelling

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Introduction: tail risk in a multi-period context

Introduction

'Stable' measures of tail risk refers to:

- Behaviour of risk measures over more than 1 period
- What characteristics do some risk measures exhibit…
- … and what characteristics should they exhibit?

Discussion rapidly leads to:

- Conditional v unconditional risk measures
- Purpose of capital
- Individual v systemic perspective

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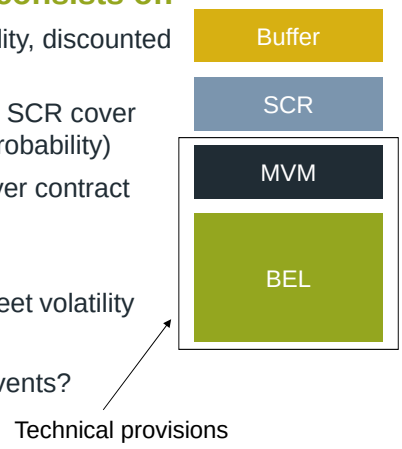
Capital requirements under Solvency II

Liability side of balance sheet consists of:

- Best estimate liability (expected liability, discounted at risk free rate)
- Solvency capital requirement (BEL + SCR cover liability in 1 year's time with 99.5% probability)
- Market value margin (cost of SCR over contract lifetime)
- Additional buffer
  - Withstand short-term balance-sheet volatility
  - Fund new business strain
  - Withstand moderately adverse events?



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How large should buffer be? Some possible approaches

Nil, i.e. able to withstand 99.5% of losses over 1 year

- Holding capital before it's required is inefficient

SCR+buffer able to withstand 99.5% of losses over runoff

- If we are likely to need further capital over time, budget for it now

What do we expect?

- Purely holding SCR means high likelihood of needing new capital if new business is written at a steady rate
- Multiyear approach should mean that more shocks can be withstood

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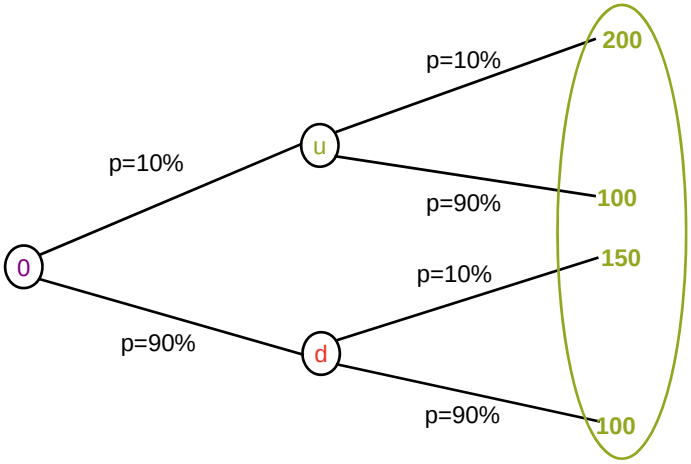
Example



Simplified version of example from Hardy & Wirch NAAJ 2004

Liability payable at time 2

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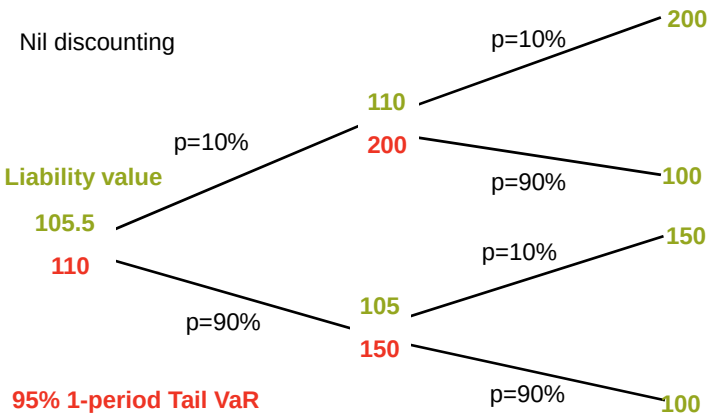
Calculate capital based on 95% Tail VaR



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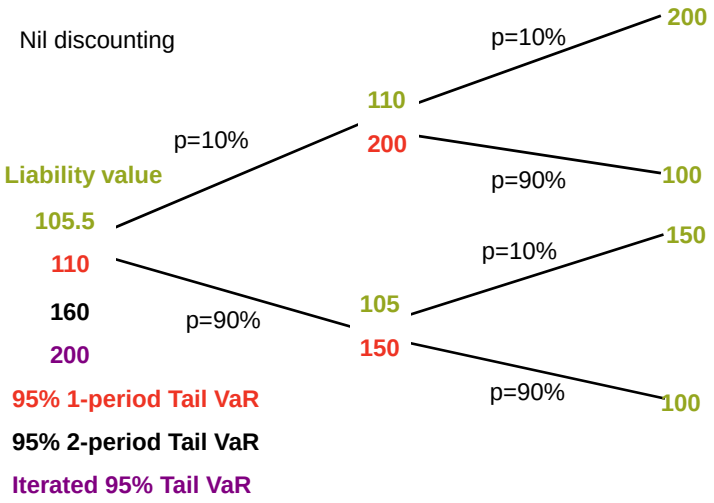
Calculate capital based on 95% Tail VaR



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How much capital to hold?

1 step ahead tail measure:

- Certain to be able to cover liability after 1 step
- But certain to need more capital after 1 step

TOO COLD?

Iterated tail measure:

- Hold excess capital in 99% of outcomes

TOO HOT?

2 step ahead tail measure:

- Ignoring intermediate step
- Need additional capital in 10% of outcomes

JUST RIGHT?

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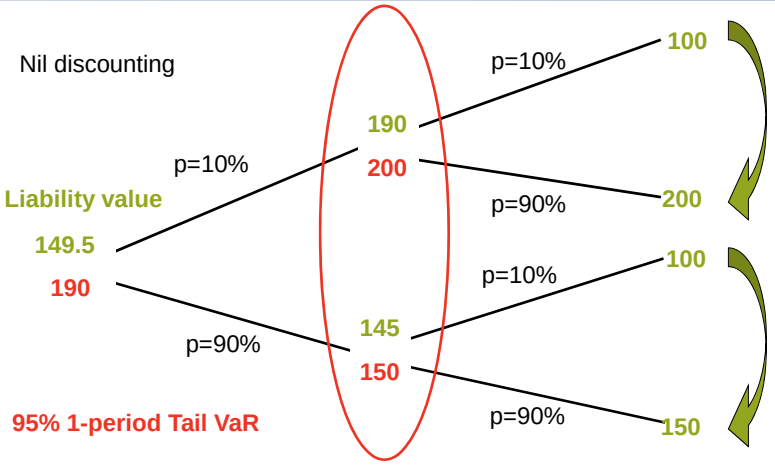
Switch outcomes: what happens?



Capital requirement unchanged

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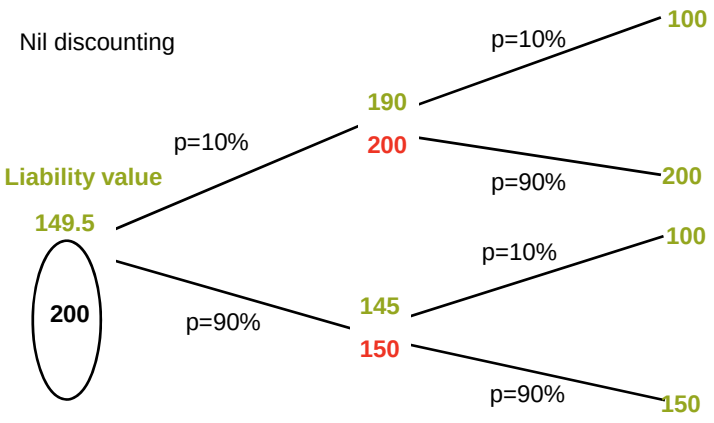
Capital requirement inconsistent



95% 2-period Tail VaR

Capital requirement increased

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So what might 'just right' look like?

Would like a capital rule that is stable in the sense that:

- It's not "too conservative" in its requirements early on
- It takes account of future capital needs
- It is relevant and dynamically consistent

Oh, and in addition

- we would like stability across economic regimes…

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The purpose of capital and impact of regulation

What are the goals of capital requirements?

- Reduce the risk of default
  - reassure capital providers, policyholders, society
- Help manage risk in a broad sense
  - set risk appetite; make risk transfer/hedging decisions; pricing; performance management and incentives
- Reduce frictional costs of raising new capital
  - Provide resource for taking on new business, M&A,...

⇒ Need a coherent way to determine capital
- **Over and above minimum regulatory requirement**
- **Over a multi-year horizon (ORSA)**

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Competing regulatory objectives

Cycles / mean-reversion	Regime shifts
Stable capital	Un-stable risk measure
Flexibility	Time inconsistency
Long-term investment	Proper risk incentives
Counter-cyclicality	Contagion

Reference: Andrew Haldane "Control rights (and wrongs)", Speech October 2011
http://www.bankofengland.co.uk/publications/speeches/2011/speech525.pdf

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Traditional vs. modern insurance regulation

- Long-term
- Claim-paying ability
- Asset-based discounting
- Implicit margins
- Judgement/discretion
- Assumptions
- Intrinsic value
- Infrequent valuation

- 1-year
- Exit/transfer value
- Exogenous "risk-free" rate
- Explicit risk-based capital
- Data
- Prices
- Intrinsic + time value
- Frequent valuation

Risk of individual insolvencies replaced with risk of systemic failure?

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Modern regulation is more pro-cyclical

Feedback results from cross-links between insurers and capital markets

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Regime dependence
Point in Time vs. Through the Cycle

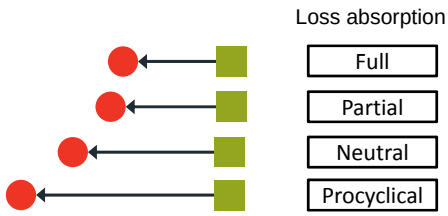
"Edge of the world" framework

- At time 0 we are at centre of the world
- We have a view of the edge

At time 1, a moderate loss occurs

4 cases:

1. Edge unmoved
2. Edge moves less than centre
3. Centre and edge both moved equally
4. Edge has moved more than centre



Extent to which losses are absorbed determines cyclical impact

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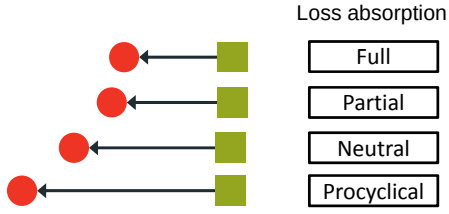
Information content of adverse event

1. is **unconditional** in price space: targets a fixed '1 in 200' price level
2. is **mean reversion**: adverse event lowers likely severity of next event
3. is **unconditional** in return space: latest event has no impact on next
4. is **procyclical**: latest event leads to strengthened view of next one



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Examples

1. Fixed absolute stress
   - Downside interest rate event may already be extremely small positive rates
   - Peak spreads from credit crisis might form a post-crisis 1-in-200 event
2. Mean reversion
   - After 20% equity fall, 40% stress might reduce to 30% (44% total)
3. Fixed relative stress
   - Expense risk stress may be unlikely to react to new expense assumptions
4. Increased stress
   - Credit crisis dramatically changed views on credit risk
   - Equity falls typically associated with higher volatility

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Solvency II

Solvency II – competing objectives

Economic based capital

- "The supervisory regime should provide for a **risk-sensitive** requirement, which is based on a **prospective** calculation" (Recital 60)
- "SCR should be determined as the economic capital to be held by insurance and reinsurance undertakings in order to ensure that … undertakings will still be in a position, with a probability of at least 99.5 %, to meet their obligations to policy holders and beneficiaries over the following 12 months" (Recital 64)

Avoid pro-cyclicality

- "mitigate **undue potential pro-cyclical effects** of the financial system and avoid a situation in which insurance and reinsurance undertakings are unduly forced to raise additional capital or sell their investments as a result of **unsustained adverse movements** in financial markets" (Recital 61)

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To earn long-term market risk premiums need to be able to withstand fluctuations

Buffer capital/ORSA	• **Excess capital sufficient to absorb volatility**
Hedging	• **Equivalent to contingent capital**
Diversification	• **Stable risk premium in tail events**
Product design	• **Fluctuations absorbed by customers**
Capital absorption	• **Absorbed by technical provisions / capital**

Reference: World Economic Forum – the Future of Long-term Investing
http://www.weforum.org/issues/future-long-term-investing
Reference: Committee on the Global Financial System, Paper no. 44, Fixed Income Strategies of Insurance Companies and Pension Funds http://www.bis.org/publ/cgfs44.htm

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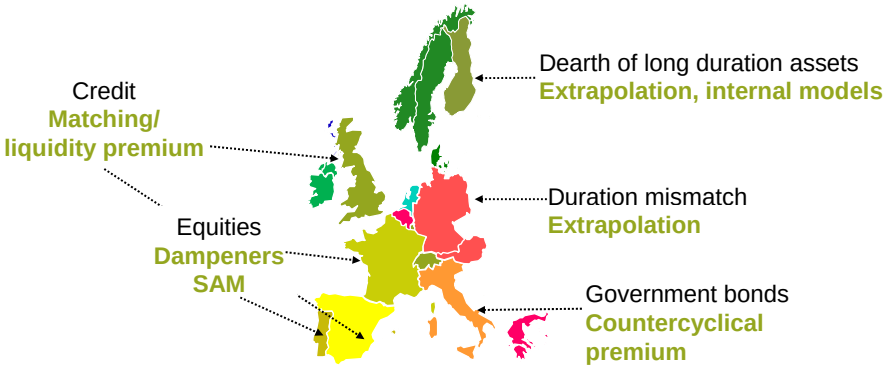
Issues and counter-cyclical mitigants

- Recovery period
- TTC calibration of Standard Model



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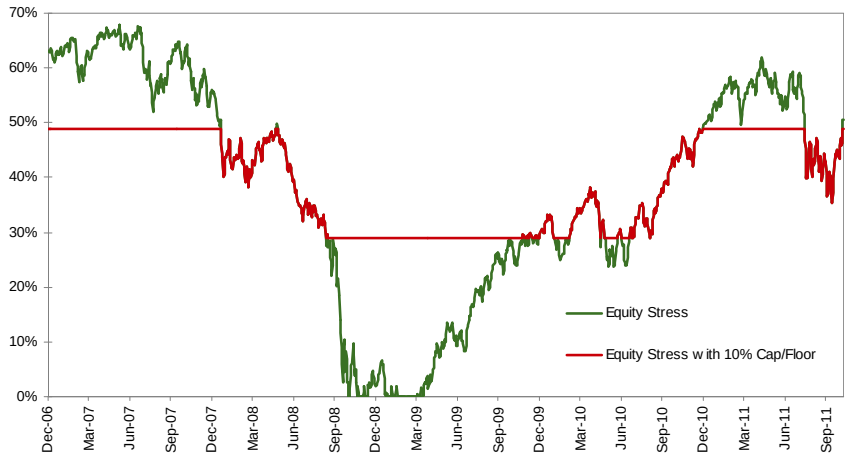
Equities symmetrical adjustment mechanism Operation - per QIS5, and Article 106(3)



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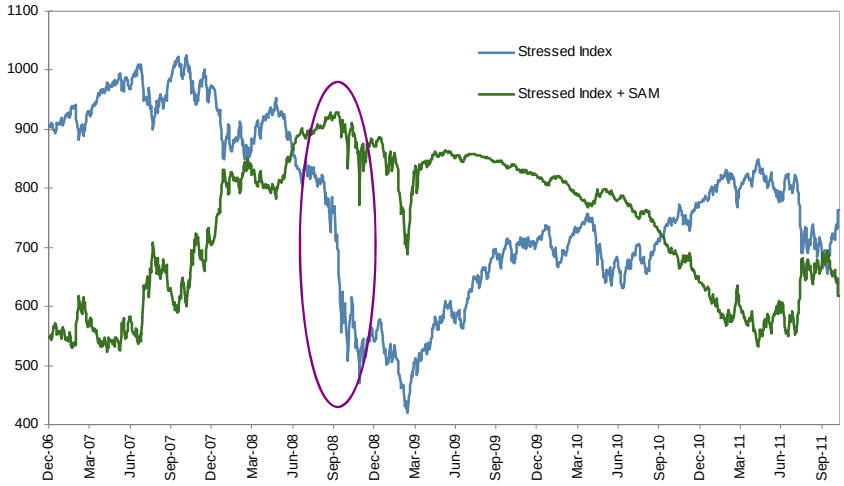
Is it effective? Yes with no cap/floor



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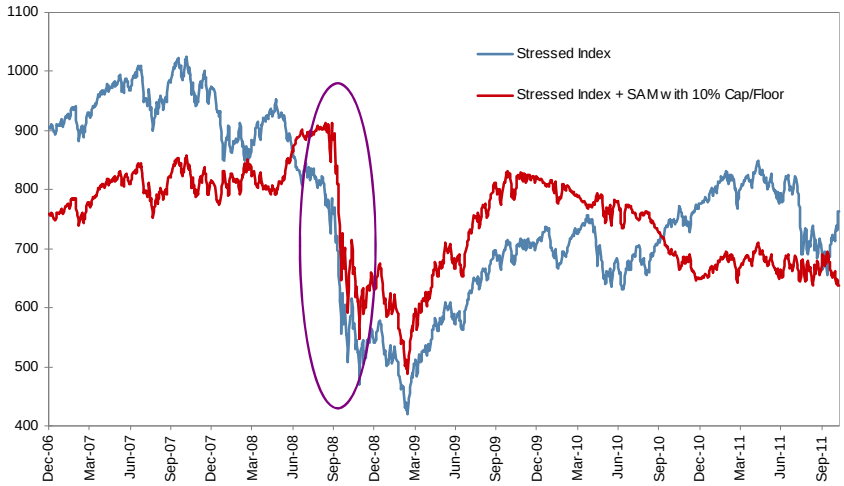
Is it effective? Cap/floor limits significantly



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Multi-period modelling

Modelling set-up discussion 1

- Want to explore how large buffer should be
- Running off a fixed set of contracts (e.g. trees earlier) doesn't capture full dynamics: other levers available include
  - Volume of new business
  - Risk hedging (investment policy, reinsurance)
  - Raising of new capital / paying out dividends
- The joint problem of setting policies for these as well as capital buffer is really what we're after

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Modelling set-up discussion 2

- Cost of capital not modelled as fixed premium to risk-free
  - More buffer means less risk to capital providers
  - Simple approach is to calculate cost according to standard deviation of projected outcomes over following year
  - Default option cost should perhaps be subtracted but should be small and ignored here

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Toy insurer

- Assume firm wants to write contracts where the risk emerges over two years
  - Notional N
  - Pay N(1+s[1]+s[2]) at end of 2 years, where s[i] is known at end of i'th year. Normally distributed.
  - Charge premium equal to MVM
- Each year, aim to write N=100 new business subject to capital availability
  - If insufficient for N=60 then raise additional capital so that N=80 can be written
  - Return excess capital to shareholders

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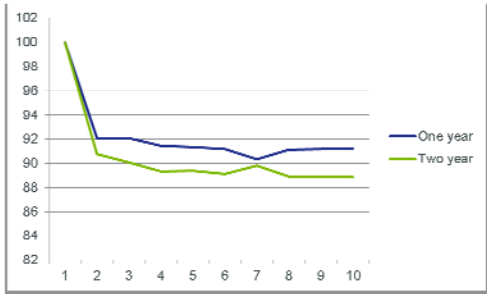
Two capital policies: new business volumes

- One year approach. Hold enough for next year (P=99.5%)
- Two year approach. Hold enough for 99.5% of runoffs
- End up writing similar amounts of business – slightly less for the two-year, as more initial capital needed to support it



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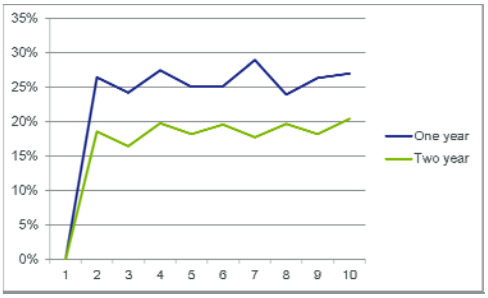
New capital raising: likelihood

- Two year buffer + limited willingness to write less business does act as a shock absorber
  - Despite policy requiring more capital to write new business
- Likelihood of seeking further capital is about a fifth lower



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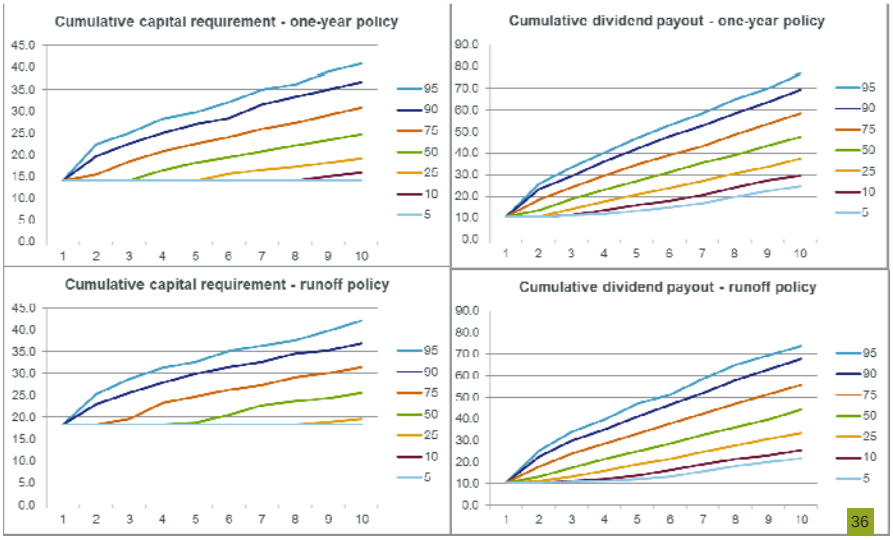
New capital raising: size



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Comments

- Total capital requirement ends up being similar over time
- Possibility of capital being unavailable or costly means future business may be difficult to execute
- Trade offs between buffer policy, level of business and frequency of capital raising

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Further work

- Need to quantify trade offs so alternative strategies can be more easily compared
- Risk adjusted return on capital
- Costs of raising capital – cf Smith (1996)
  - Suggests a zone for buffer capital – raise capital or pay dividends on borders of this zone
- Insurance v financial risk
  - Is there a difference? Why take financial risk when there's a capital cost?

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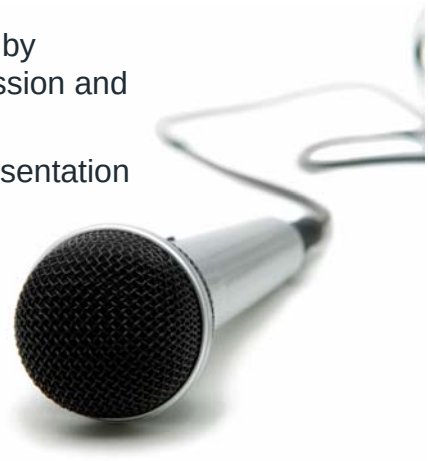
Questions or comments?

Expressions of individual views by members of the Actuarial Profession and its staff are encouraged.

The views expressed in this presentation are those of the presenters



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