The Actuarial Profession
making financial sense of the future

Finance and investment conference
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Stable risk measures
Working party update

Working party members

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Agenda

Introduction: tail risk in a multi-period context

The purpose of capital and impact of regulation

Regime dependence

Multi-period modelling

Introduction: tail risk in a multi-period context

Introduction

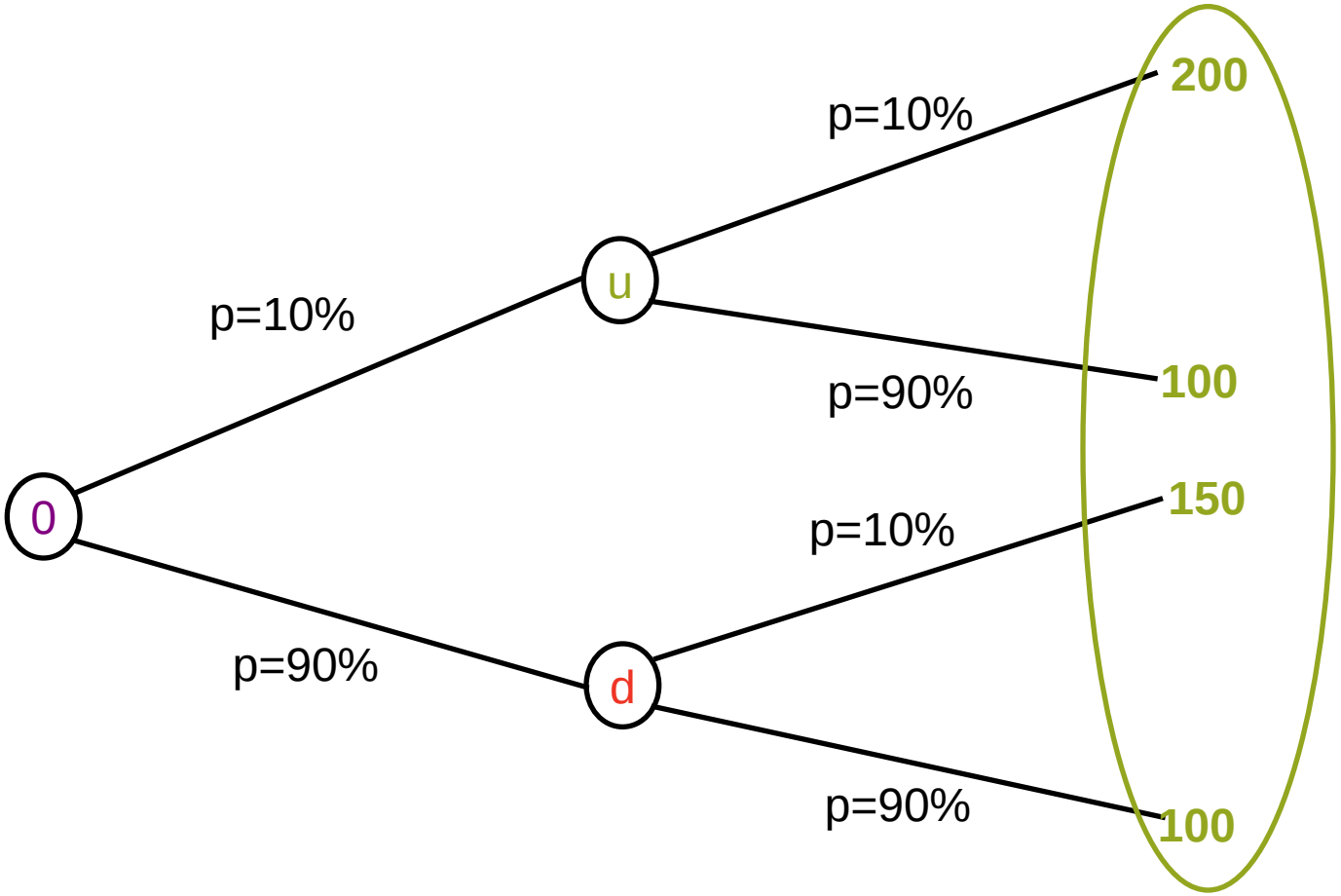
‘Stable’ measures of tail risk refers to:

- 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

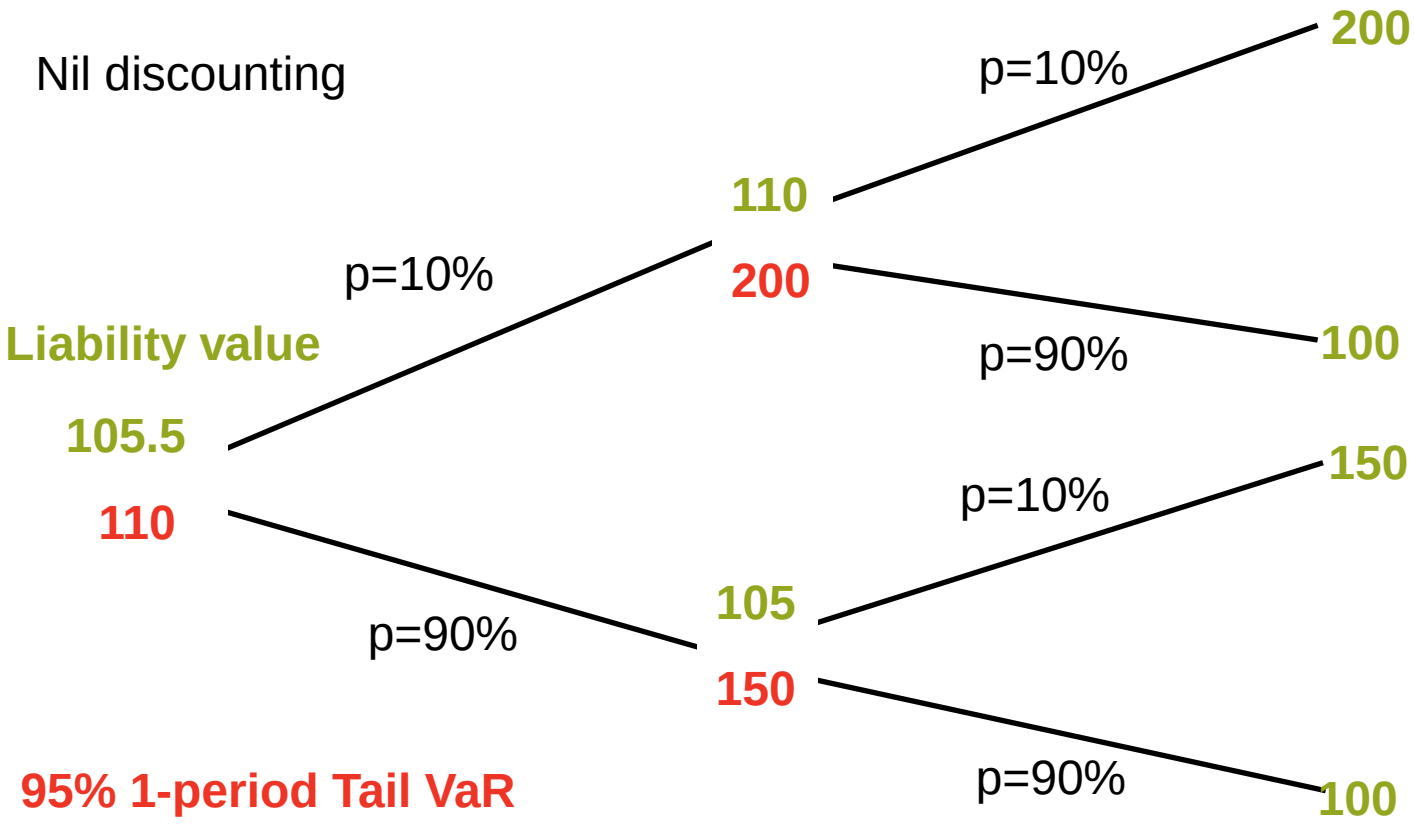
Example



Simplified version of example from Hardy & Wirch NAAJ 2004

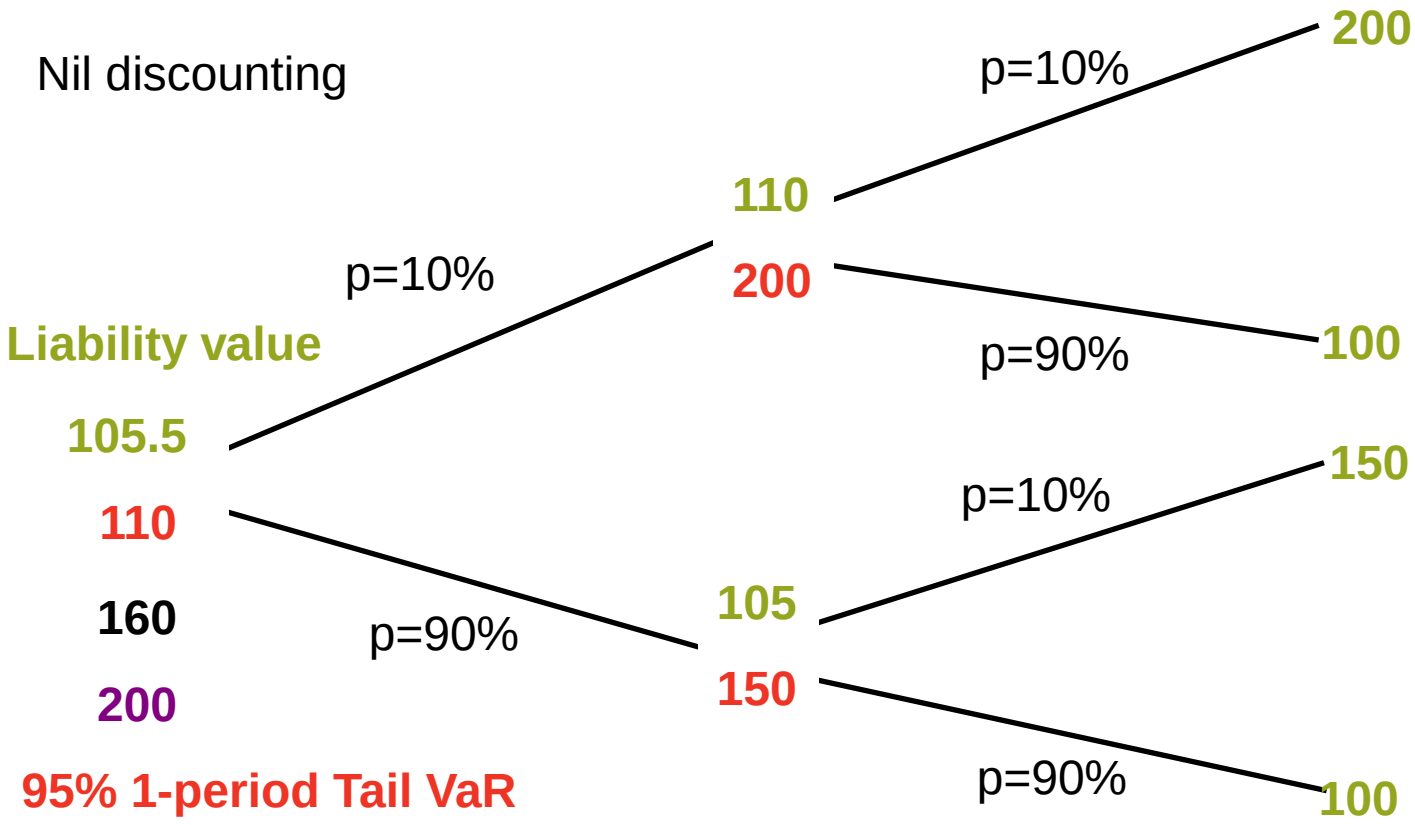
Liability payable at time 2

Calculate capital based on 95% Tail VaR



Calculate capital based on 95% Tail VaR

Nil discounting



95% 1-period Tail VaR

95% 2-period Tail VaR

Iterated 95% Tail VaR

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

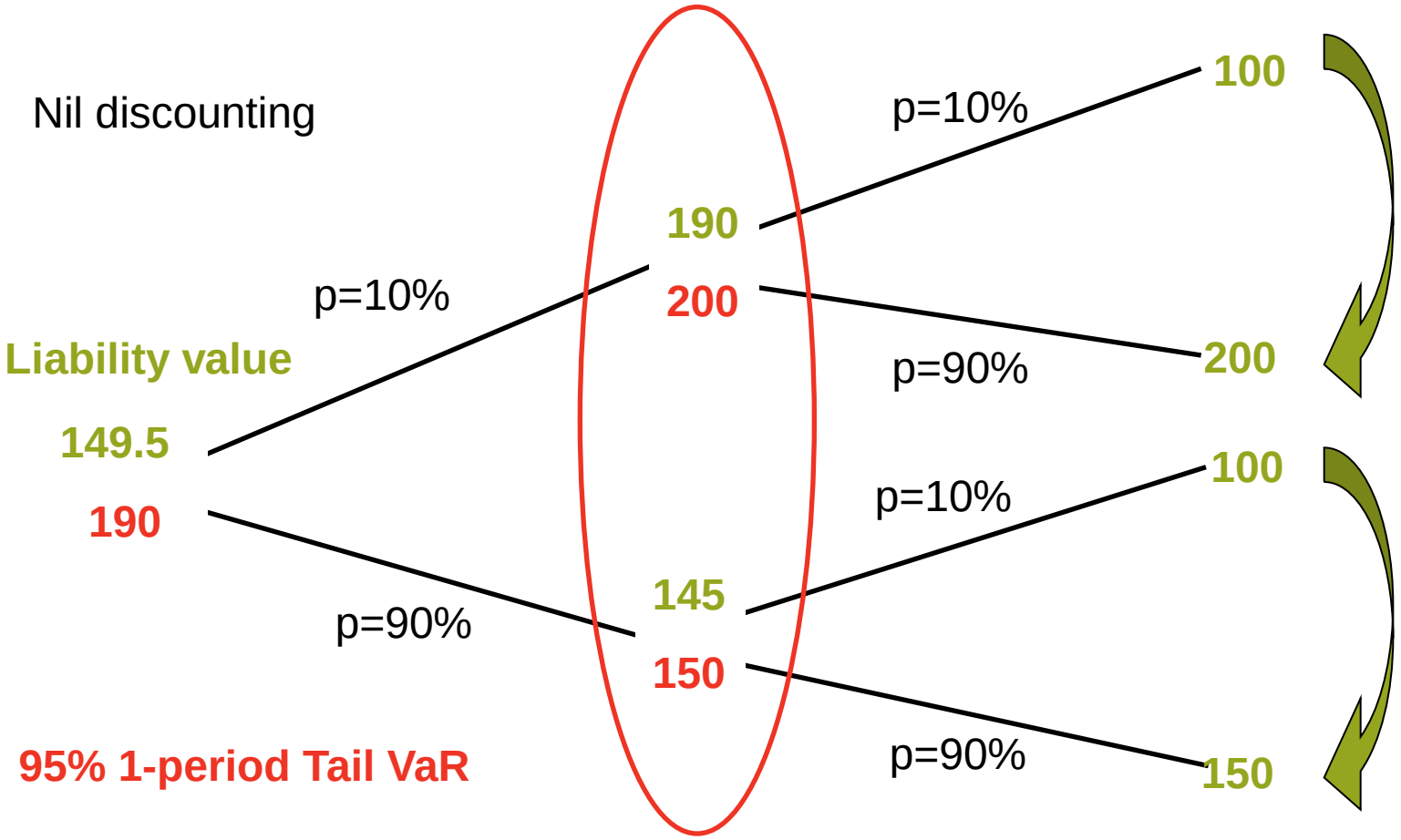
TOO HOT?

2 step ahead tail measure:

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

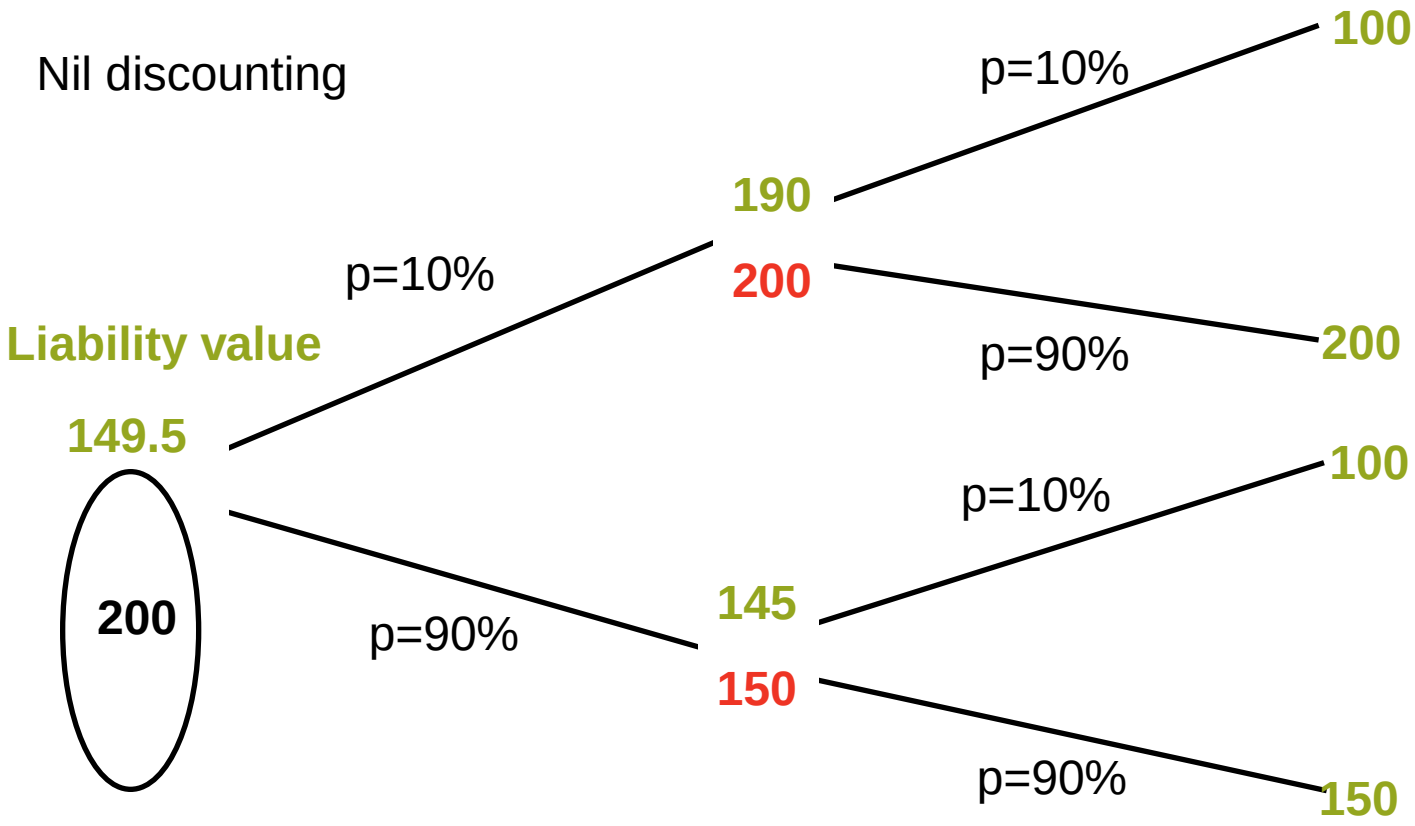
JUST RIGHT?

Switch outcomes: what happens?



Capital requirement unchanged

Capital requirement inconsistent



95% 2-period Tail VaR

Capital requirement increased

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…

The purpose of capital and impact of regulation

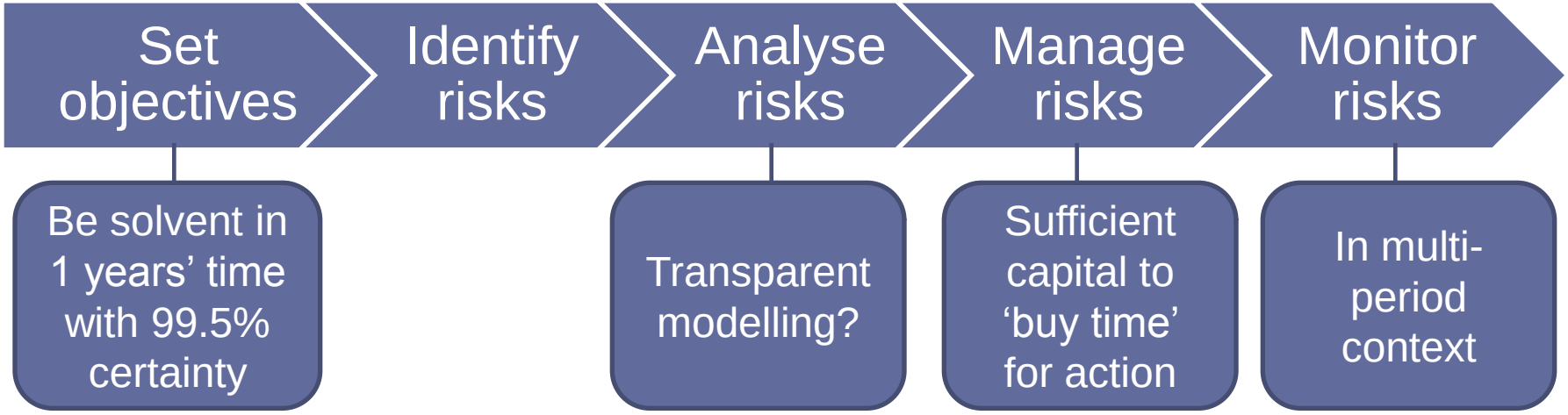
Why is this question interesting?

- Insurers required to hold capital against potential losses
- Regulatory test is 1 year but business plan is longer
  - Own Risk and Solvency Assessment (ORSA)
- So need a coherent way to determine capital
  - Over and above regulatory requirement
  - Over a multi-year horizon

What is the goal of capital?

- Reduce the risk of default
  - and so reassure capital providers, policyholders, society
- Reduce bankruptcy costs
  - and so increase economic wealth
- Help manage risk in a broad sense
  - set risk appetite etc by line of business; understand risk drivers; make risk transfer decisions; drive pricing,....
- Provide resource for taking on new business, M&A,...
- Help asset-liability management
- Performance management (of different business units etc)
- Incentivise staff

Setting capital within risk management process



- Some markets mean-revert some of the time (probably)
- All models subjective, tail risk more so (less data)
- Regulation sets 'fixed' objective – adjusts analysis so capital requirements stable
- Could flex objective through cycle/have longer term objective and PIT in model

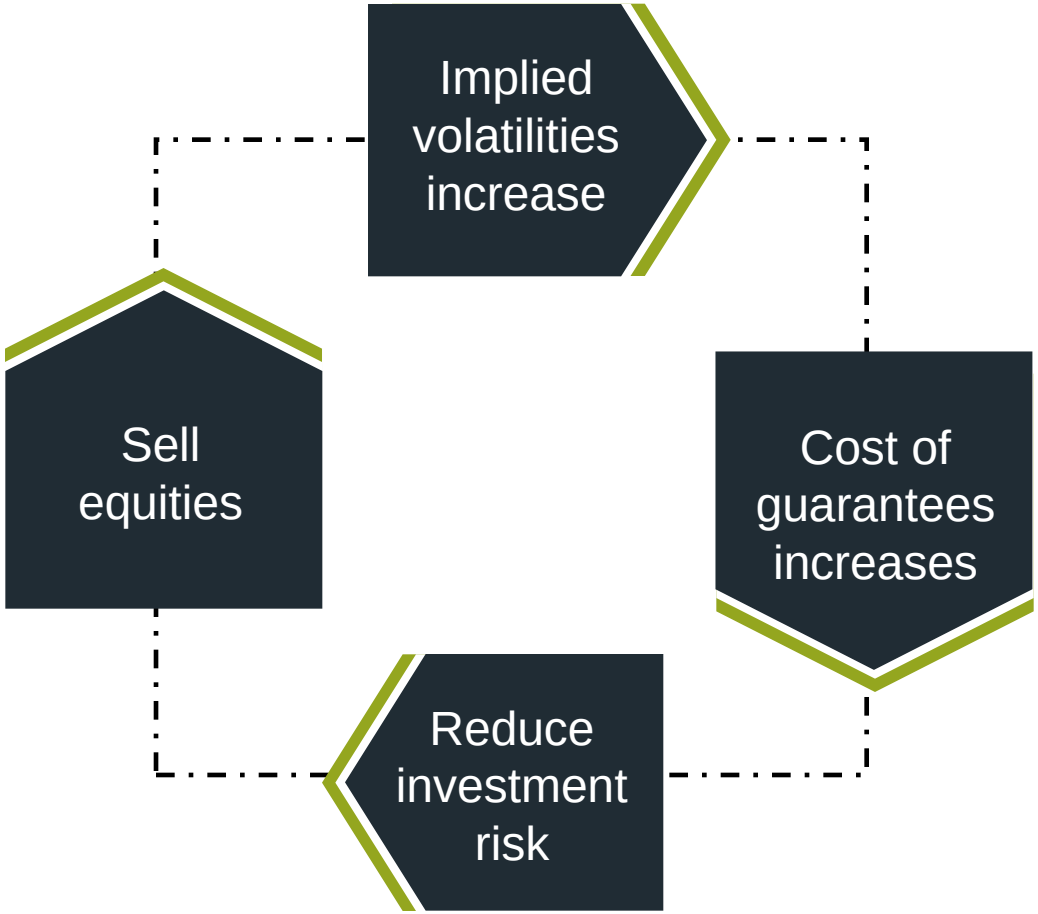
Traditional v modern insurance regulation

- Long-term
- Claim-paying ability
- Asset-based discounting
- Simultaneous margins
- Top up with LTICR
- Judgement/discretion
- Assumptions
- Intrinsic value
- Infrequent valuation

- 1-year
- Exit/transfer value
- Risk-free discounting
- Individual stress tests
- Net off diversification
- Data
- Prices
- Intrinsic + time value
- Frequent valuation

Risk of individual insolvencies replaced with risk of systemic failure?

Modern regulation is more procyclical



Feedback results from cross-links between insurers and capital markets

Pro/counter cyclical features in Solvency II as per QIS5

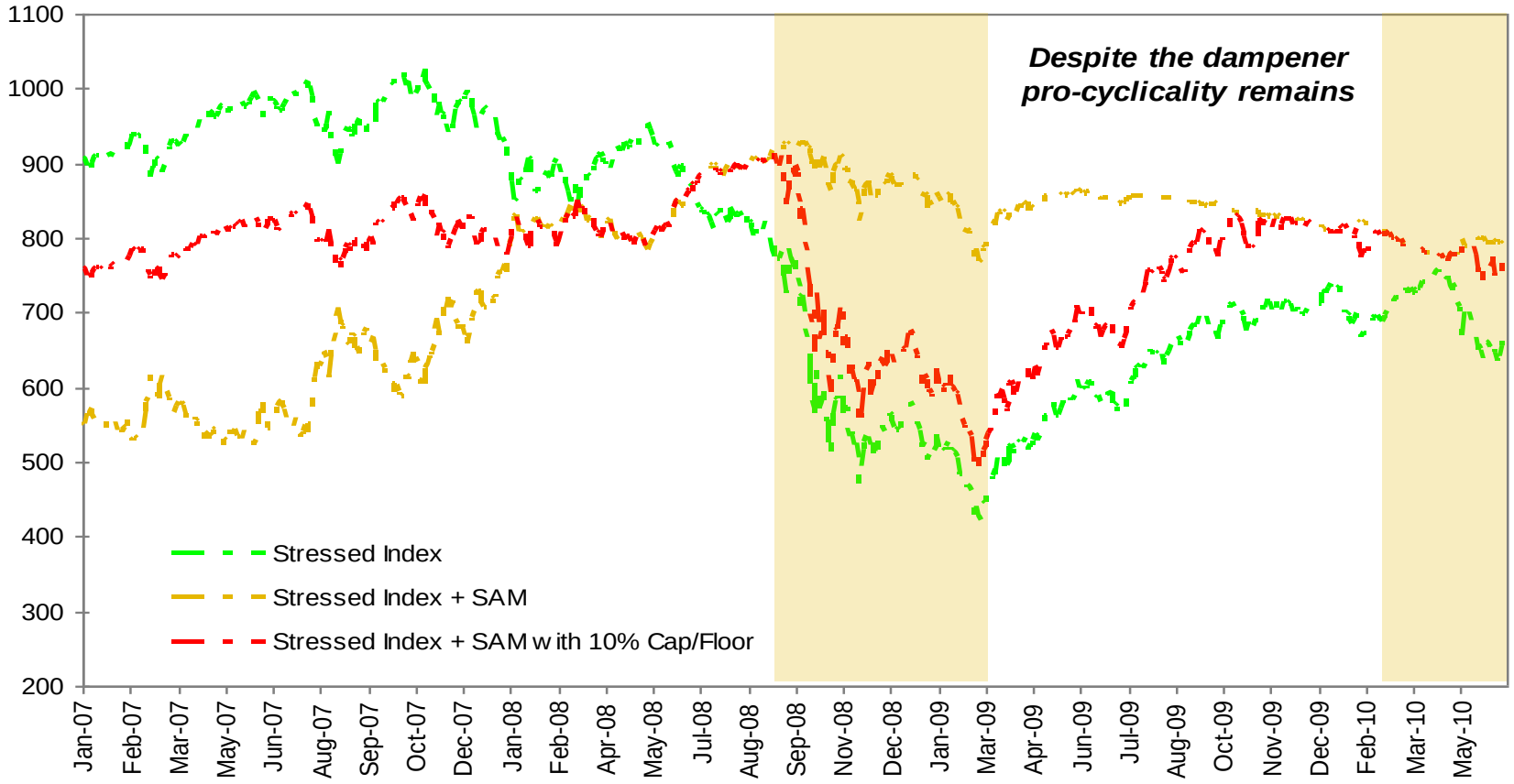
- Market based and systemic (applies to all insurers in EU)

Mitigants

- Recovery period
- Calibration
- Equity risk
- Interest rates
- Credit risk/liquidity premium

Solvency II symmetrical adjustment mechanism

MSCI World Index – Impact of Symmetric Adjustment Mechanism



Source: RBS; QIS5 Draft Technical Specifications; CEOPS L2 Final Advice

Basel

- Aims (July 2010 consultation)
  - Manage credit growth in growth phase
  - Manage credit constraints in downturn
- Method
  - Capital conservation buffer
  - Set nationally based on private sector credit/GDP ratio + judgement

Table 2C.1: The credit to GDP gap before banking crises

	Year -1			Year -2			Year -3			Year -4			Year -5		
	max	min	mean	max	min	mean	max	min	mean	max	min	mean	max	min	mean
Very severe crises															
FI 1991q3	14.24	11.90	13.22	12.56	10.38	11.76	11.58	9.85	10.99	8.30	7.35	7.70	7.19	6.46	6.78
GB 2007q3	10.86	8.97	10.03	9.74	4.43	6.33	3.02	2.75	2.86	0.91	-0.87	0.05	-0.63	-1.39	-0.92
IE 2008q3	58.12	48.63	53.20	49.16	36.33	41.89	42.11	34.17	37.55	26.85	20.25	23.86	16.16	9.10	12.59
JP 1992q4	5.05	0.58	2.46	9.93	5.09	7.12	13.51	10.22	11.77	12.89	10.53	12.08	13.41	10.75	12.01
MX 1994q4	19.55	17.62	18.30	19.92	17.94	19.00	20.18	15.49	17.50	15.96	12.97	14.18	13.37	12.61	13.01
NL 2008q3	22.86	13.04	19.50	13.53	8.20	9.98	16.77	9.82	12.94	14.32	12.99	13.56	12.13	10.57	11.25
NO 1990q4	14.74	8.84	13.20	25.26	16.03	20.09	25.96	25.05	25.43	27.82	24.71	26.38	28.88	17.26	24.34
SE 1991q3	18.75	7.26	12.17	20.79	17.02	19.47	21.15	13.38	17.49	15.37	5.52	8.52	11.39	6.15	7.52
US 2007q3	11.93	11.11	11.52	10.15	8.46	9.20	8.26	6.93	7.72	8.35	7.32	7.79	9.83	8.47	9.25
Group specific															
Mean	19.57	14.21	17.07	19.01	13.76	16.09	18.06	14.18	16.03	14.53	11.20	12.68	12.41	8.89	10.65
Min	5.05	0.58	2.46	9.74	4.43	6.33	3.02	2.75	2.86	0.91	-0.87	0.05	-0.63	-1.39	-0.92
Max	58.12	48.63	53.20	49.16	36.33	41.89	42.11	34.17	37.55	27.82	24.71	26.38	28.88	17.26	24.34

Regime dependence

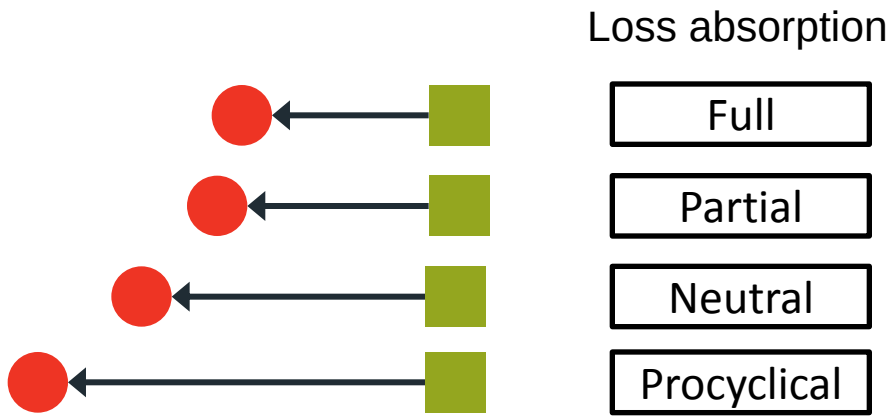
“Edge of the world” framework

- 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:

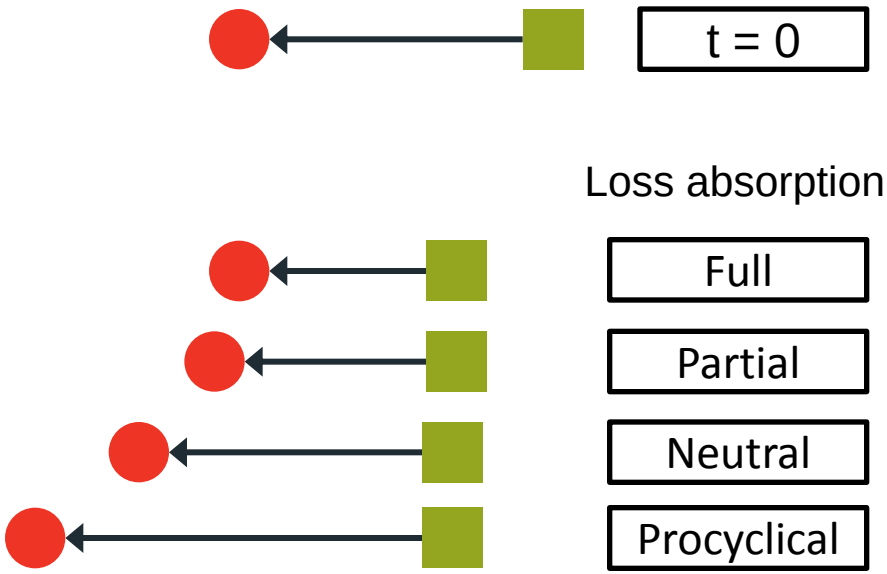
1) Edge unmoved
2) Edge moves less than centre
3) Centre and edge both moved equally
4) Edge has moved more than centre



Extent to which losses are absorbed determines cyclical impact

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



Examples

(1) Fixed absolute stress

- Downside interest rate event may already be extremely small positive rates
- Peak spreads from credit crisis might be 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

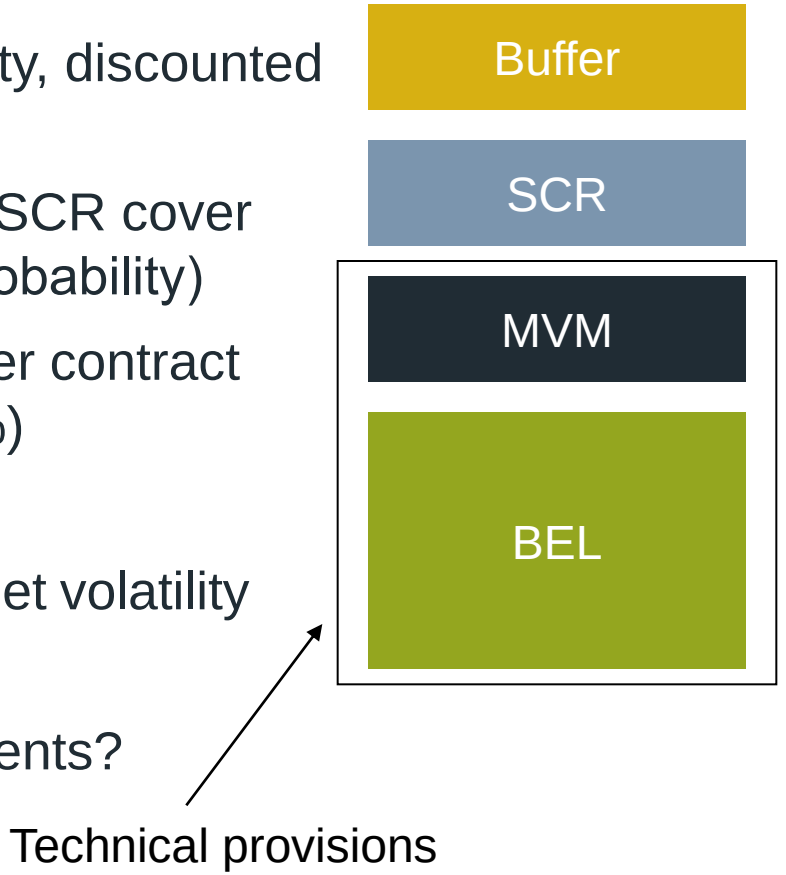
- Credit crisis dramatically changed views on credit risk; plausible to foresee much larger risks than were apparent before the crisis

Multi-period behaviour

Capital requirements under Solvency II: terminology

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, assumed to be risk free + 6%)
- Additional buffer
  - Withstand short-term balance-sheet volatility
  - Fund new business strain
  - Withstand moderately adverse events?

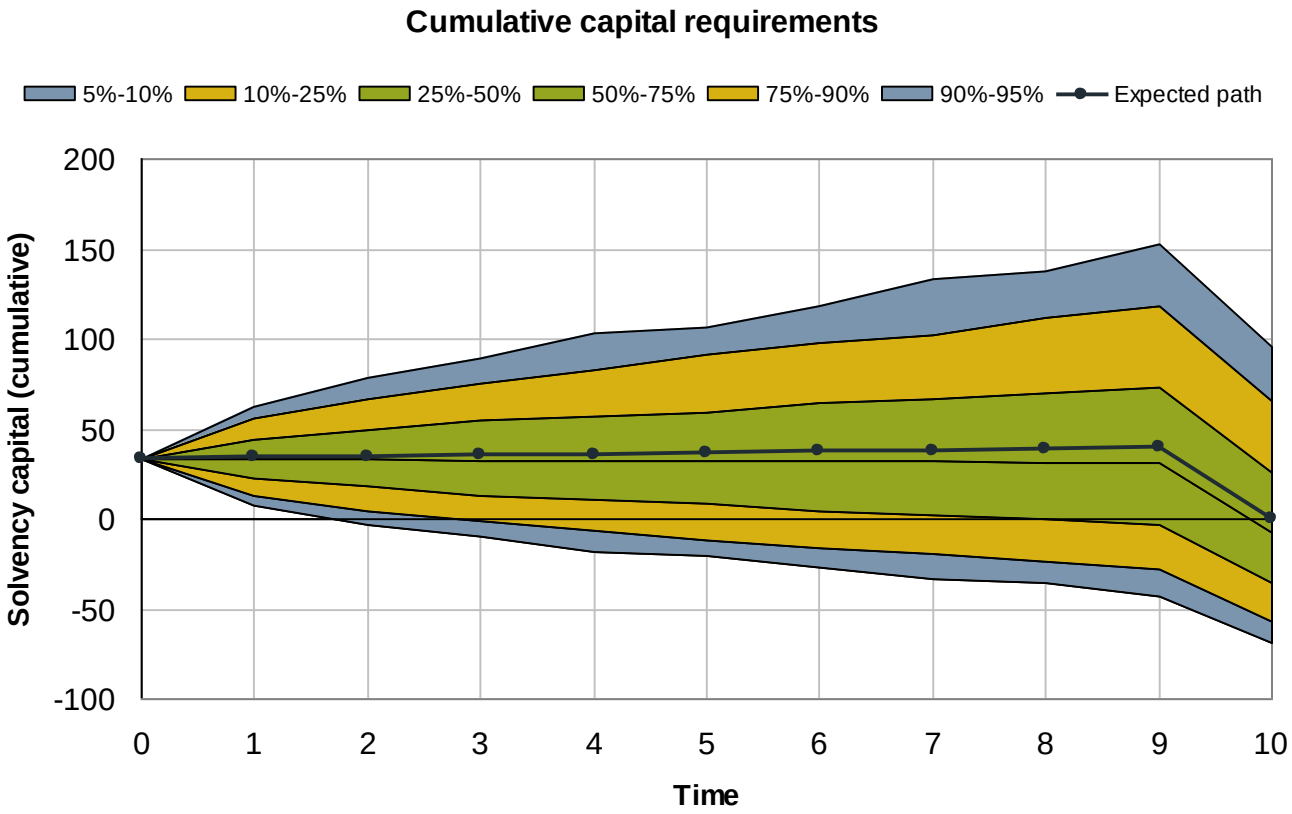


Example contract

- Payout depends on experience over 10 year period
- Experience in each year is iid normal, z[i]
- Payout is 100.exp(z[1]+…+z[10])
- Easy to calculate BEL, SCR, MVM
- Question: should we hold a buffer? What should it be?

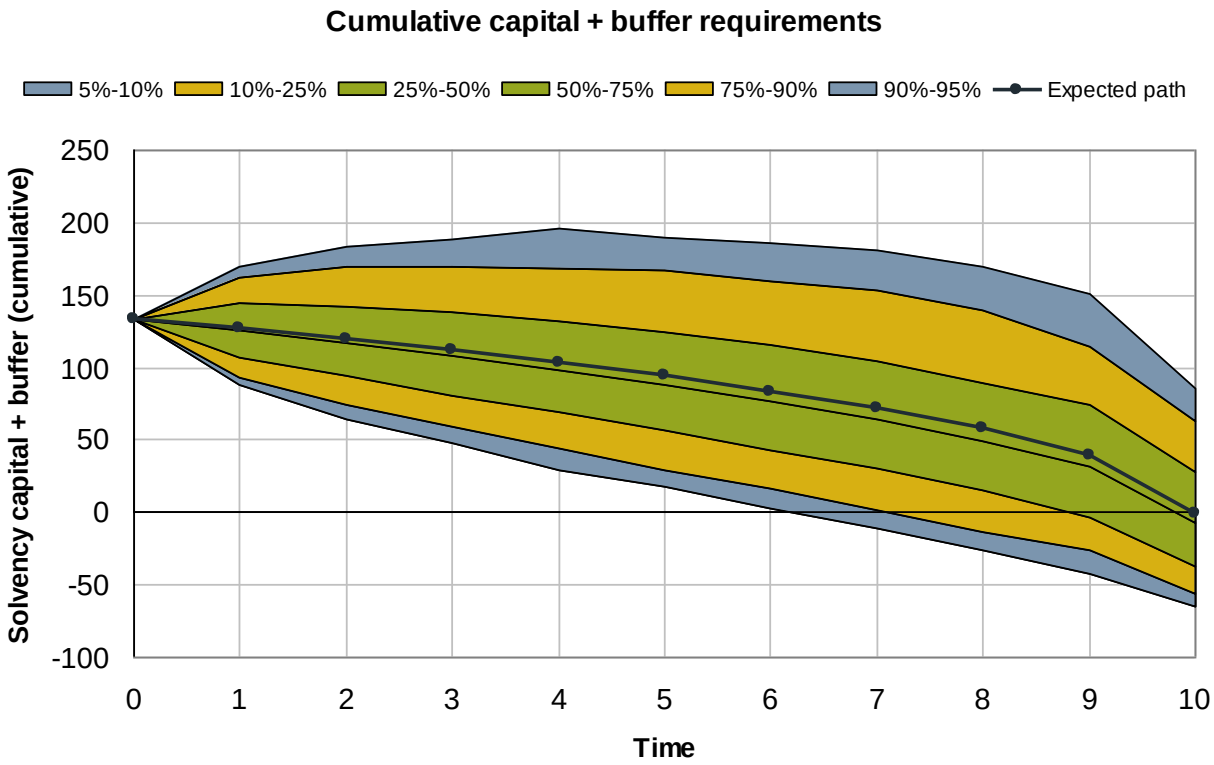
- Parameters: z[i]~N(3%,10%), 2% discount

Example #1: Hold 1-year 99.5% VaR at each time (no additional buffer)



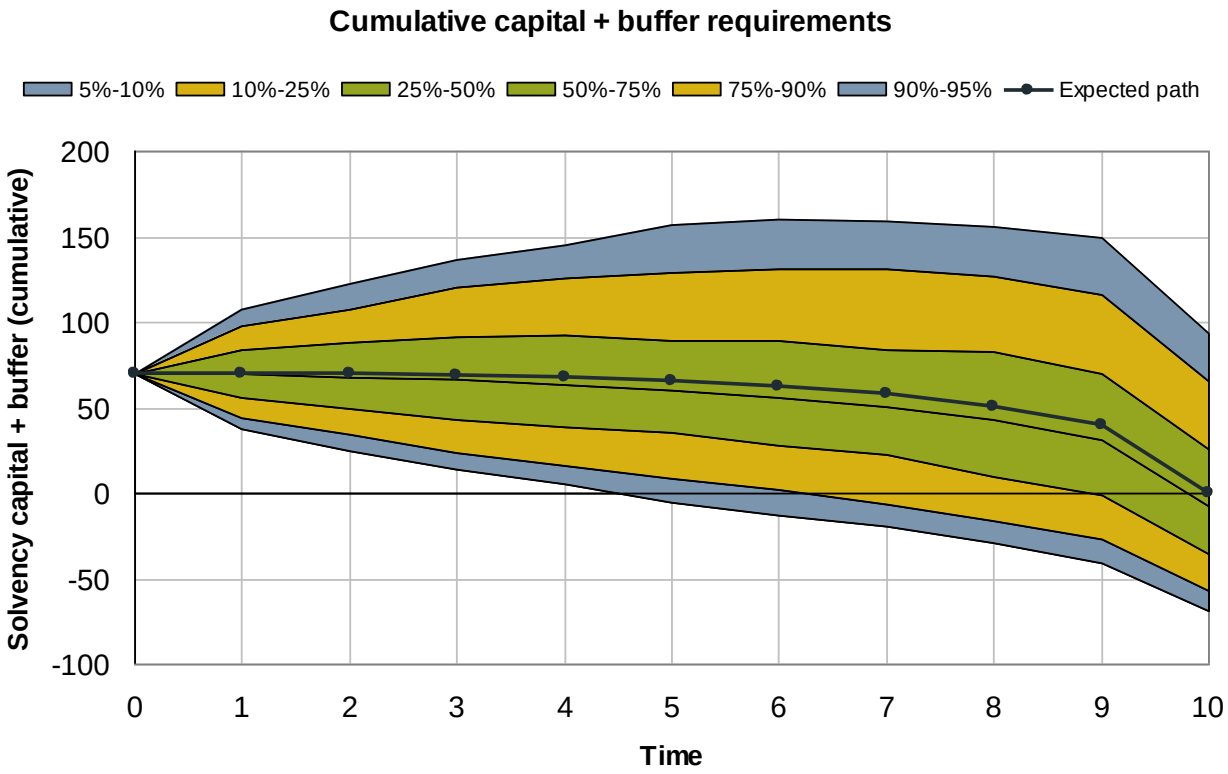
- Likelihood of needing more capital each year around 50%
- Expect to release capital at end of contract

#2: Hold additional buffer based on 99.5% prob of having sufficient capital at contract maturity



- Buffer large compared to SCR
- Still 30% likelihood of nearing additional buffer after 1 year
- Capital released gradually as residual risk reduces

#3: Prob of having sufficient buffer at contract maturity increases from 95% to 99.5%



- Intermediate case
- 50% likelihood of nearing additional buffer after 1 year; this probability falls over time

Conclusions

- High variability in capital buffer with all 3 rules
  - This is positive: should expect good (poor) experience to lead to release (or raising of additional) capital
- Annual change in buffer can be:
  - Same each year (exposure identical)
  - Reducing over time (residual risk falls)
- In this case longer term perspectives don't seem to reduce variability but do increase initial capital
  - Rolling 1-year VaR might be a good answer after all!

Future work

- Modelling
  - Dynamic feedback in the parameter estimation
  - Fatter tails / Poisson events
- What should a ‘stable’ capital policy look like
- Keen to hear others’ ideas / experience

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 presenter.