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IFRS & US GAAP: International Financial Reporting for Insurers
August 30 – September 1, 2010

Hong Kong

IFRS Phase II Implementation Issues

Simon Walpole

Actuaries
Risk is Opportunity!

IFRS-Phase II Implementation Issues

Simon Walpole

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A Few Issues

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- Discount rates
  - What is “risk free”?
  - Unobservable durations
  - Illiquidity premiums
- Need for sophisticated models
  - Asset modelling needed in order to derive liability values
  - Stochastic-in-stochastic
- Choice of economic scenario generator
- Speed
  - Common ways to speed up models
  - Data grouping techniques
  - Replicating portfolios & “lite models”
- Checking & audit
- Others (if there’s time…)

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Discount Rates

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Discount Rates

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- From IFRS4 ED:

Time value of money

30 An insurer shall adjust the future cash flows for the time value of money, using discount rates that:

(a) are consistent with observable current market prices for instruments with cash flows whose characteristics reflect those of the insurance contract liability, in terms of, for example, timing, currency and liquidity.

(b) exclude any factors that influence the observed rates but are not relevant to the insurance contract liability (eg risks not present in the liability but present in the instrument for which the market prices are observed).

31 As a result of the principle in paragraph 30, if the cash flows of an insurance contract do not depend on the performance of specific assets, the discount rate shall reflect the yield curve in the appropriate currency for instruments that expose the holder to no or negligible credit risk, with an adjustment for illiquidity (see paragraph 34).

- Risk-free, full term structure, currency-matched, illiquidity adjustment
- "Risk free" defined only as "no or negligible credit risk"
  - No mention in the ED of "government bond yields" or "swap rates"

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Risk-Free Rate: GBY or Swap?

- Silence of ED implies can choose
- Swap rates have historically generally been higher than government bond yields, especially for shorter durations
- But the graph shows recent negative spread on 30-year USD papers
- **Make choice, then stick with it**

Source: http://seekingalpha.com/article/195425-is-the-u-s-government-single-a-rated

HK Exchange Fund Notes

Table 5.3.1 : End of period figures
期末數字

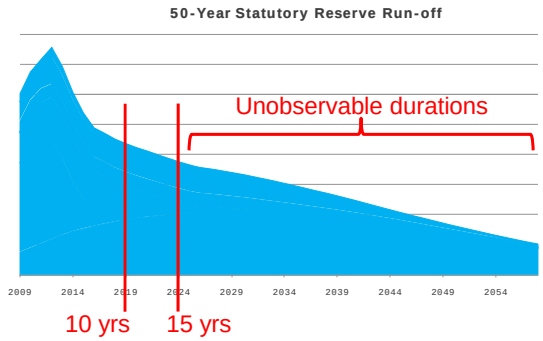
(percent per annum)
(年率)

As at end of 期末數字			Exchange Fund Bills 外匯基金票據						Exchange Fund Notes 外匯基金債券						
			7-day 7日	30-day 30日	91-day 91日	182-day 182日	273-day 273日	364-day 364日	2-year 2年	3-year 3年	4-year 4年	5-year 5年	7-year 7年	10-year 10年	15-year 15年
2010	Jan	1月	0.04	0.05	0.09	0.18	0.20	0.22	0.53	0.99	1.48	1.83	2.43	2.82	2.92
	Feb	2月	0.03	0.06	0.10	0.16	0.20	0.22	0.59	0.91	1.34	1.67	2.33	2.70	2.85
	Mar	3月	0.04	0.05	0.10	0.15	0.18	0.21	0.75	1.25	1.59	1.95	2.45	2.79	2.92
	Apr	4月	0.03	0.07	0.11	0.12	0.16	0.18	0.61	1.22	1.68	2.04	2.58	2.88	3.02
	May	5月	0.16	0.20	0.26	0.28	0.30	0.34	0.71	1.00	1.30	1.61	2.16	2.51	2.70
	Jun	6月	0.58	0.58	0.62	0.62	0.62	0.63	0.77	1.06	1.35	1.55	1.99	2.29	2.38
	Jul	7月	0.04	0.09	0.27	0.30	0.33	0.35	0.48	0.67	1.01	1.29	1.81	2.23	2.35

- For HK$ liabilities:
- Rates currently very low – not clear if IFRS reserve < HK stat reserve
- Observable only for 15 years

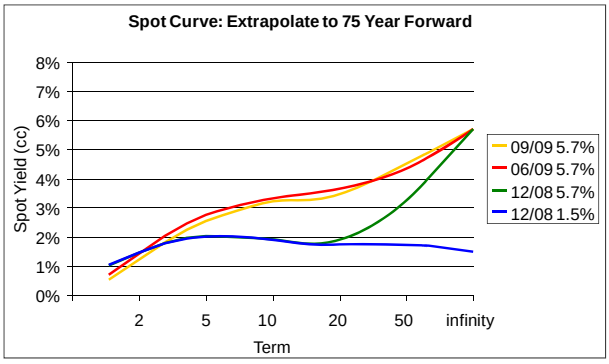
HK$ Liabilities

- HK$ liabilities are generally much longer than duration of longest Exchange Fund Notes
- Discount rates are therefore needed for durations which are **not observable** on HK$ risk-free yield curves (either EFN or swaps)
- *[Much less of a problem for US$ liabilities]*



Approach for Unobservable Durations

- Until 2008, it was common just to extrapolate the observed yield curve using a sensible curve
- At Dec 2008, however, 15-yr EFN yield < 10-yr EFN yield
- Extrapolation gave blue line, which was not popular
- "Mean reversion at infinity" approach devised – magic "infinity" figure = 5.7%



Adjustment for Illiquidity

- From IFRS4 ED and Basis for Conclusions:

34 Many insurance liabilities do not have the same liquidity characteristics as assets traded in financial markets. For example, some government bonds are traded in deep and liquid markets and the holder can typically sell them readily at any time without incurring significant costs. In contrast, policyholders cannot liquidate their investment in some insurance contract liabilities without incurring significant costs, and in some cases they have no contractual right to liquidate their holding at all. Thus, in estimating discount rates for an insurance contract, an insurer shall take account of any differences between the liquidity characteristics of the instruments underlying the rates observed in the market and the liquidity characteristics of the insurance contract.

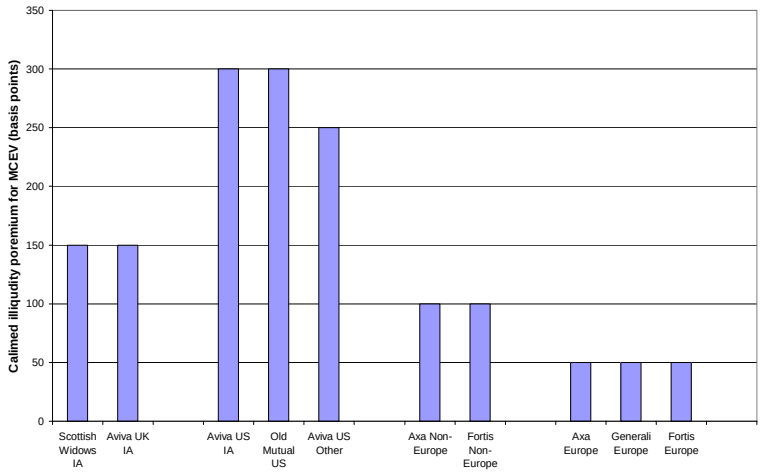
BC100 The Board concluded that, in principle, the discount rate should reflect the liquidity characteristics of the item being measured. The Board then considered input from preparers of financial statements, academics and regulators on how such a liquidity premium can be measured. That input suggests that there is not yet a consensus on how best to measure those effects, for example how to separate liquidity effects from credit effects. Concerns about those issues became greater during the financial crisis of recent years, as spreads widened dramatically.

BC101 The Board believes that it would not be appropriate, in a principle-based approach:

(a) to provide detailed guidance on how to estimate liquidity adjustments.

(b) to prescribe a discount rate that ignores the liquidity characteristics of the item being measured or uses an arbitrary benchmark (eg high quality corporate bonds) as an attempt to develop a practical proxy for measuring the specific liquidity characteristics of the item being measured.

Illiquidity Premiums used in MCEV as at Dec 31, 2008



Illiquidity Premium Estimation Methods

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- So there's no consensus
- Various methods have been and are used, including:

Method	Description	Main Limitations
Covered Bond	Yield on government-guaranteed corporate bonds minus yield on government bonds	Few bonds exist in most currencies, and these bonds are often quite liquid so attract low illiquidity premiums
Reliable Yield	Bond spread minus "prudent" (ie 2x) historic defaults	Premium for uncertainty in defaults counted as illiquidity premium
Structural Model	Bond spread minus theoretical value of put option to default	Illiquidity premium counts missing elements in option pricing model
CDS Basis	Bond spread minus CDS spread	Illiquidity premium estimate includes counterparty credit risk on CDS and ignores illiquidity priced into CDS itself

Illiquidity Premium vs Yield Spread: Various Estimates

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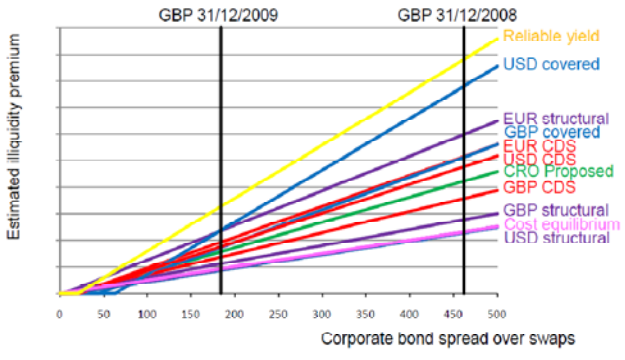
- Depending on which method you use, you get very different illiquidity premiums, especially when corporate bond spreads are wide
- Choice will have a major impact on liability valuation
- How to get consensus?



Source: CRO forum risk free calibration / Deloitte calculations.

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Actuarial Models

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Best Estimate Liability
Basic Calculation Approach

Best-estimate liability =

PV(Full future benefits & policyholder dividends)
\+ PV(Policy expenses & commission)
\- PV(Full gross premiums)

Basis = current best estimate, market consistent
Discount rate = risk-neutral rates *(time dependent)*
but cash flows must allow for investment risk

Similar to a gross premium valuation, but with a market consistent allowance for risk – particularly investment risk

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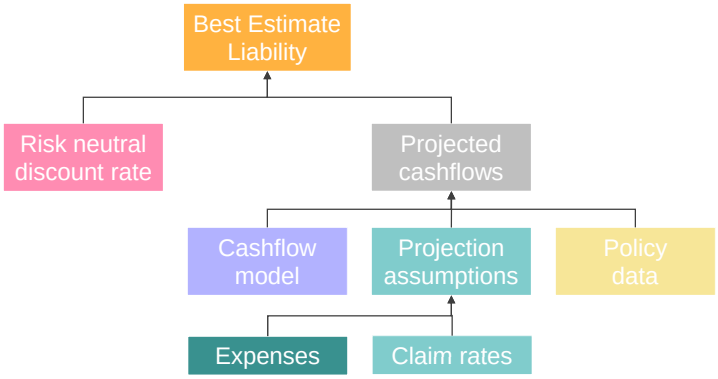
Best Estimate Liability: Non-Par



Issues: Non-Par

- Not that difficult computationally – essentially a GPV but using a full term-structure yield curve
- BUT: dynamic lapses?
- Would a policyholder lapse (to buy a new policy)? When?
- Dynamic lapses =>
  - Lapse rates and cash flows depend on economic assumptions
  - Not symmetric => stochastic calculations needed

Best Estimate Liability: Par

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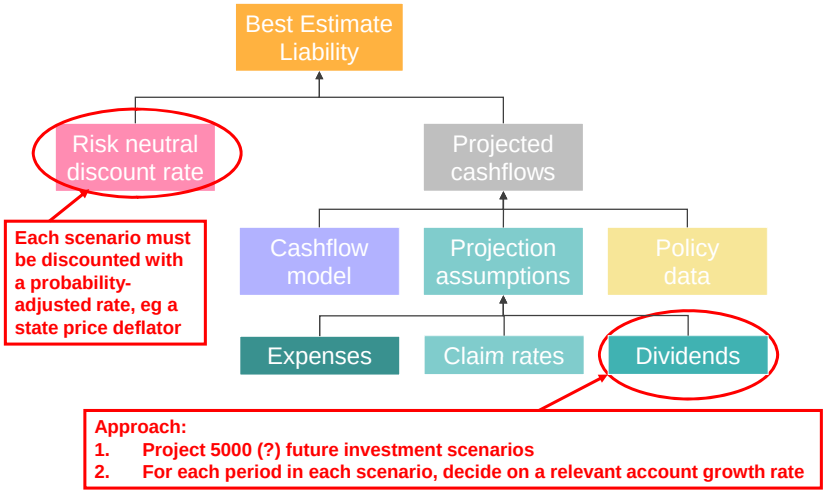

Calculation Sequence

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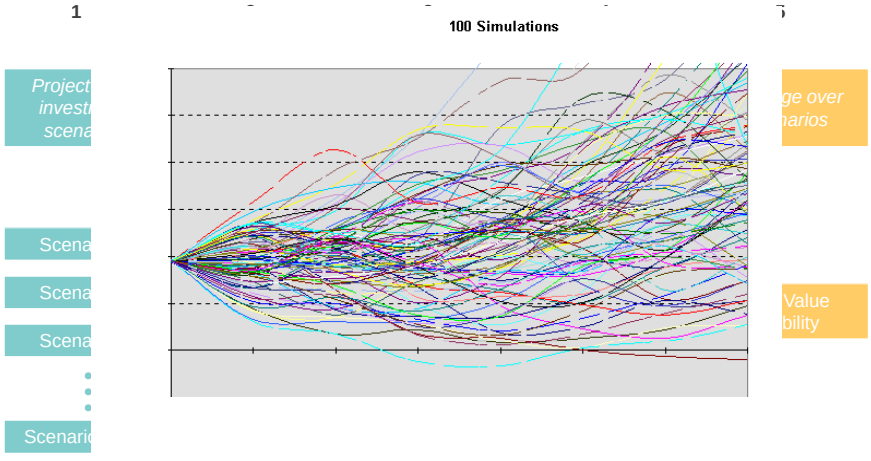
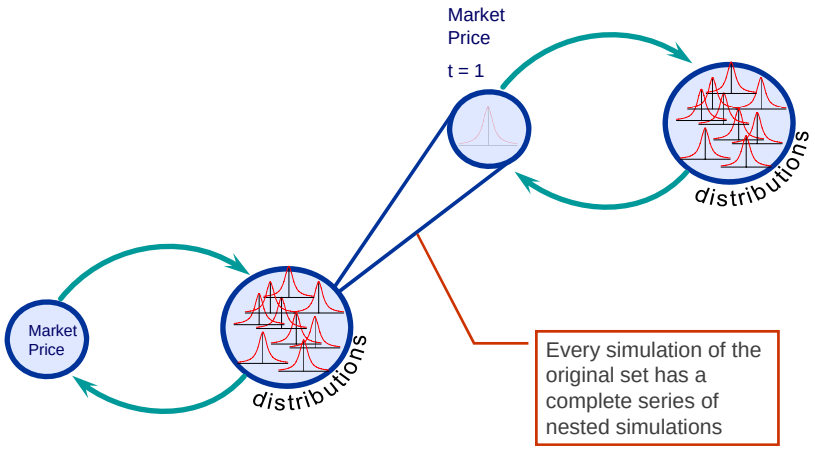


Issues: Par

- Gated funds
  - Dividends normally set to exhaust fund, ie total dividends depend on fund value
  - Shareholder dividends need to be modelled too, as they deplete the fund
  - Shareholder injections if fund shortfall possibly not symmetric (0/100 in, 90/10 out?)

  => need to model total fund value too
  - Seriatim plus aggregate calculations…
- Gated and non-gated funds
  - Policyholder dividends depend on asset returns
  - Need to model assets too? (eg if dividends depend on book returns)
- Dynamic lapses…

Projecting Fair Values: Nested Simulations



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Choice of Economic Scenario Generator

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Requirements of a Robust ESG

- It is relatively simple to construct an economic model which produces large numbers of simulations of future economic variables
- But an appropriately robust ESG is harder to construct
- Required inherent properties
  - Comprehensive outputs
  - Arbitrage free
  - Market consistent calibration is possible
  - Fat-tailed distributions
  - Mean reversion only where relevant
  - Does not allow negative interest rates
  - Symmetric variable construction
  - Continuous time model

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Requirements of a Robust ESG

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- Desired practical properties
  - Date first published
  - Possible for users to change parameters
  - Access to source code
  - Easily calibrated
  - Fast to run
  - Variance reduced simulations available automatically

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Comprehensive Outputs

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- Range of assets to include:
  - Equities
  - Property
  - Risk-free bonds
  - Corporate and other bonds which are not risk-free
  - Inflation
  - Index linked bonds
  - Foreign exchange rates
- For each asset class, a range of measures is generally required:
  - Yields
  - Prices
  - Total Return Index
  - Capital Return Index
  - Income Index
  - Yield Curve
- Outputs ideally available on a monthly basis, for each currency

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Arbitrage-Free & Market-Consistent

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- If a calibration is not arbitrage-free, it would mean that returns on some assets could be higher than on others with the same risk
- Process to test that a model is arbitrage free:
  - Begin with the market value of an asset portfolio at the current date
  - Project forward the cash flows from the asset portfolio using the outputs from the economic model for a large number of scenarios
  - Discount these back to the current date using the appropriate discount factors that are generated by the same economic model
  - Take the mean discounted value at the current date
  - Arbitrage-free if the mean discounted value of the cash flows equals the market value of the assets as at the date of the investigation
- Market-consistency is critical for fair value calculations
  - Interest rates for all scenarios begin with the actual observed yield curve
  - Harder to achieve than it might be thought

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Out-of-Date Comparison of ESGs

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Inherent Features				
Arbitrage free?	✓	✓ (*)	✗	✗
Market consistent calibration possible?	✓	✓	✗	✗
Fat tailed distributions?	✓	✗	✓	✗
Mean reversion on interest rates?	✓	✓	✓	✓
Does not mean revert on asset prices (eg equities)?	✓	✓ (*)	✗	✗
Do not allow negative interest rates?	✓	✓	✓	✓
Symmetric model?	✓	✗	✗	✗
Continuous time model?	✓	✓	✓	✗ (annual)
Practical Features				
Possible for user to change parameters?	✓	✓	✗	✓
Possible to see the source code?	✓	✓	✗	✓
Easily calibrated?	✗	✗	✗	✗
Fast to run?	✓	✗	✓	✓
Variance reduced simulations automatically available?	✓	✓	✗	✗
Stochastic mortality?	✓	✓	✗	✗

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Working Party Paper on Common Economic Models

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Study carried out in 2003:

- "Risk and Capital Assessment and Supervision in Financial Firms"
- Produced for the Finance & Investment Conference 2003 by a UK working party of individuals from various different companies and consultancies who were working in "a strictly personal capacity"

"We modelled the run-off of a single cohort of a 10 year unitised with-profits bond, as defined below. We used 4 different economic scenario generators to assess the amount of capital required to provide the guarantees on the product."

Central Run Definition: Liability product

1 10 year UWP Bond
2 No charges
3 No expenses
4 No tax
5 Regular bonus at a fixed rate of 4%
6 Terminal bonus at maximum(0, asset share less the accumulated fund)
7 Shareholder transfers on a charges less expenses basis
8 Maturity benefit = MVA free payout at 10 years
9 No deaths
10 Lapses at 3% p.a.

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Working Party Paper on Common Economic Models

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Assets

1 Bond returns based on a 10 year rolling bond (derived by comparing ZCB prices for 9 and 10 year ZCB's each year)
2 Equity backing ratio 60%

General

1 Results shown for 10000 simulations
2 Discounted values calculated at 4.5% for all models - 4.5% represents average yield on a 10 year ZCB for all models at the start
These are calculated in this sheet and can be switched on / off as desired

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Extract from Working Party Paper

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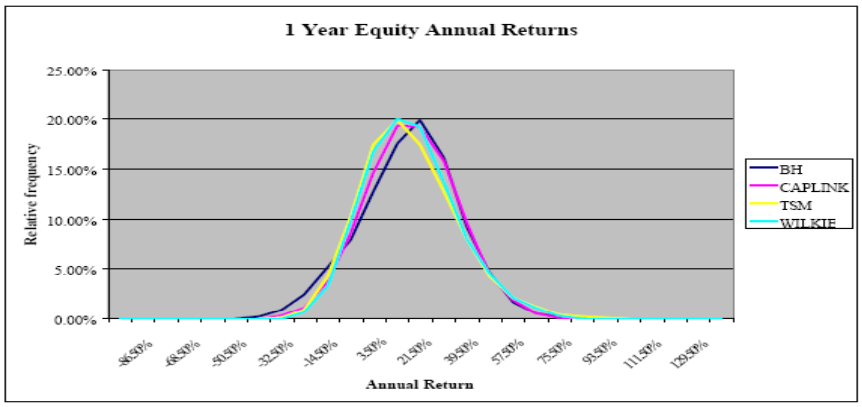

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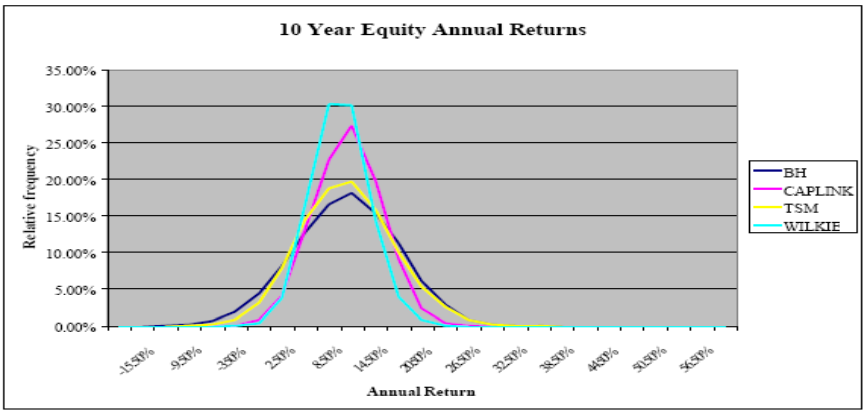

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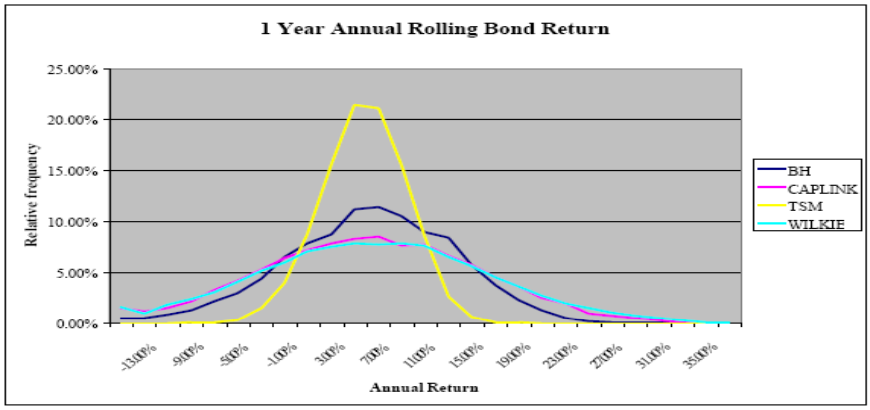

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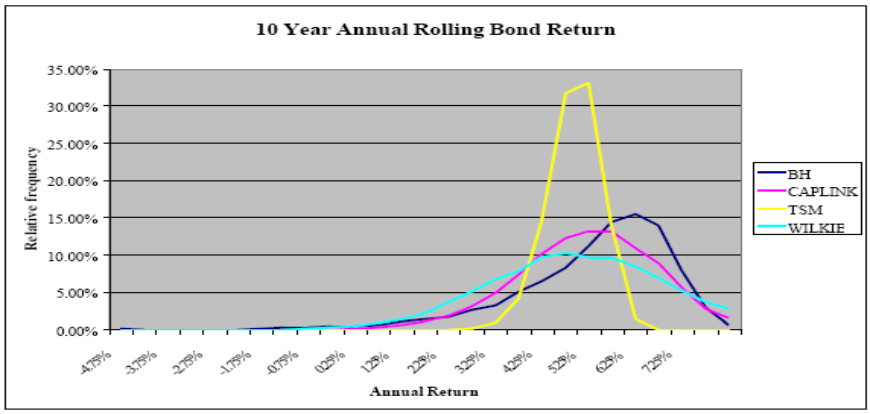

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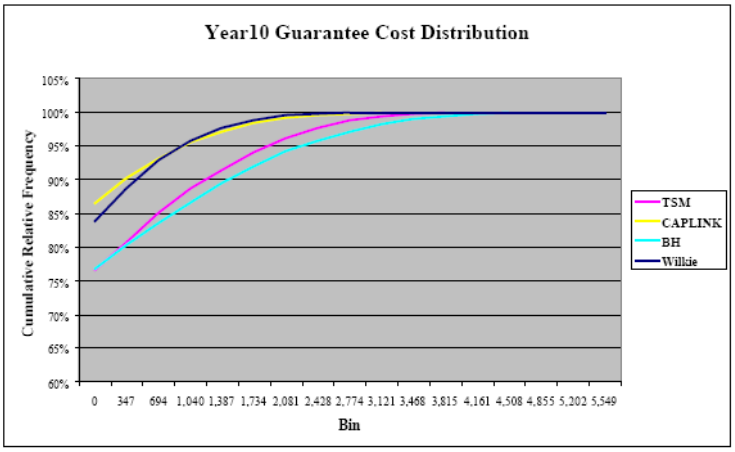

Speed

Run-Time

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- Say that one run (eg FAS 60) takes 12 hours for the full portfolio
- Stochastic => minimum of 1,000 simulations
- Sensitivities for disclosures + analysis of change for disclosures => x20 (?)
- Total run time is then 12 hours x 1,000 x 20 = 240,000 hours
  = 10,000 days

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Ways to Speed Up Models

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Item	Type	Name	Description	Significance	Effort Required
1	Hardware / Software	More CPUs	Increase the number of CPUs being used.	High	Low
2	Hardware / Software	More Powerful PCs	Use more powerful PCs, i.e. use PCs with more powerful CPUs, RAM and hard disk.	High	Low
3	Hardware / Software	Stable Network	Maintain a stable network among PCs during parallel run.	Low	Low
4	Hardware / Software	Choice of Compilers	Use Microsoft C++ / Intel compilers instead of Borland compilers during production runs.	High	Low
5	Model Point s	Model Point Grouping	Model Point Grouping	High	Medium
6	Model Point s	Product Splitting	For products with a huge amount of model points, "split" the products by setting up several new products "same as" these big products. The model points of the original products can then be "partitioned" into the new products created.	Variable	Low
7	Run Settings	Target Calculated Variables	Limit variables being calculated in "Run Structure".	Variable	Low

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Model Point Grouping

- Grouping involves (a) speeding up run-time, but (b) at the cost of losing accuracy
- Testing for run-time is simple - you just do a run and compare how long it takes
- Testing for accuracy is done by examining the results for what you care about. It generally covers:
  - Different types of results, including PV measures, reserves and cash flows
  - Different time points, including the valuation date (main one) and some future ones
  - Different assumption sets, eg base assumptions and sensitivities
  - Accuracy measure, eg 0.5% for all things / most things
- Grouping rules reliable only for the data set in question
  - At later dates, with new data, the grouping rules must be reviewed
- Specifics of policy data, product features and assumptions all impact how effective the grouping is
  - Not possible to develop a set of rules that works now that will also definitely work in the future
- Important to develop an understanding of the data and what drives the results

Model Point Grouping

- "Simple"
  - Take every 4th policy, multiple results by 4
- "Simple with Sorting"
  - Sort the data by key characteristics first, then apply Simple method
- "Scientific"
  - Use data preparation program to apply grouping rules based on specific criteria
- "Algorithm"
  - Use one of the above methods, then apply an algorithm to find weightings to the data to get the "best" fit

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Avoiding doing lots of runs (?)

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- Closed form formulae
  - Using carefully calibrated Black & Scholes-like techniques
  - Requires care and substantial financial economics knowledge
  - Often does not work well
- Risk geographies
  - Very neat, "easy" for senior management to visualize
  - Can be set up before year end, then used quickly at year end
  - Still need to calibrate using full models, but hopefully fewer runs overall
- Replicating Portfolios
  - Mentioned in ED BC97: "If a replicating portfolio exists and can be measured directly, there is no need to use a building block approach for the part of the liability that is replicated by that portfolio. The measures of the replicating portfolio and the replicated cash flows arising from the liability are identical"
  - Similar advantages to risk geographies

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Risk Geographies

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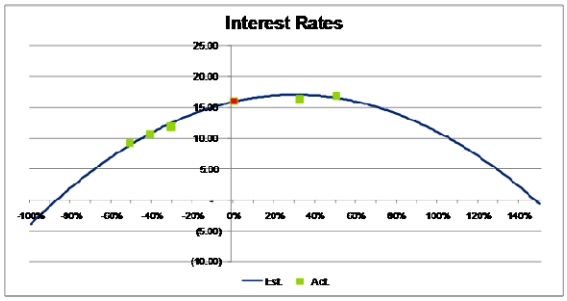
- BEL = $aX^2 + bY^2 + cZ^2 + dX + eY + fZ + g + hXY + iXZ + jYZ$
- Where the independent variables X, Y, Z represent the stress level of the risk drivers, eg
  - X = risk-free rates
  - Y = equity volatility
  - Z = lapse rates



- If this doesn't work, try BEL = $aX^3 + bY^3 + cZ^3 + dX^2Y + eX^2Z + fY^2X + gY^2Z + hZ^2X + iZ^2Y + jXYZ + kX^2 + lY^2 + mZ^2 + nXY + oXZ + pYZ + qX + rY + sZ$

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Replicating Portfolios

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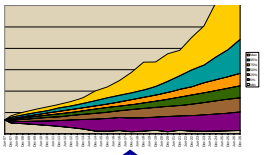
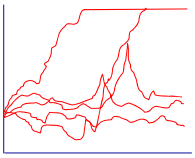
5. Output – updated liabilities, sensitivities or projections



4. Choose suitable candidate assets

Insurance Contract	Capital Market Equivalent
Guaranteed Liabilities	Zero Coupon Cashflows
Maturity guarantees	Put Option
Option to annuitise	Interest Rate Swaption

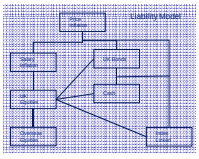
3. Generate cash flows under defined scenarios



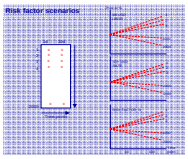
Optimization Engine

Replicating Portfolio

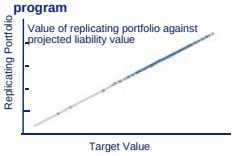
2. Actuarial cash flow projection system



1. Choose economic scenarios



6. Validate through detailed testing program



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Checking & Audit

What to look at

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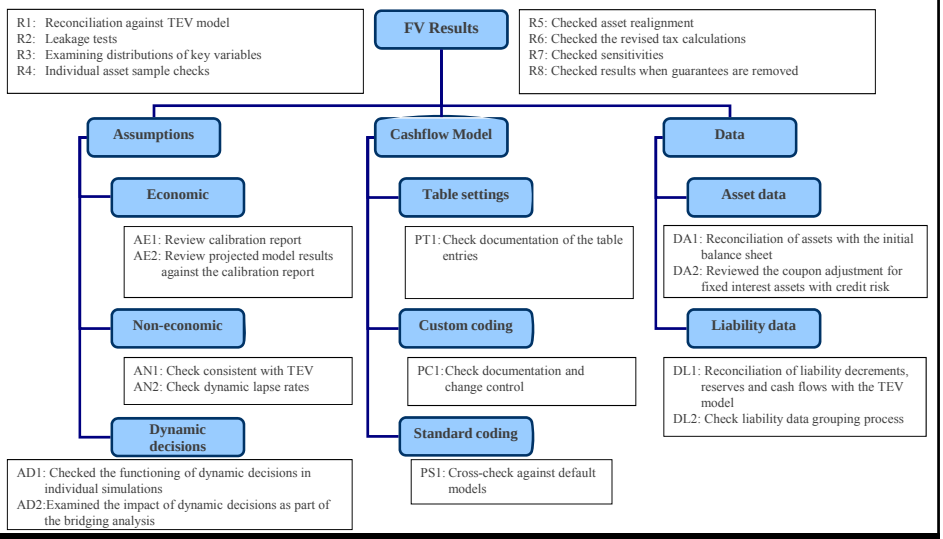

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Other Issues

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Other Issues

- Lots of open questions in the ED still
  - Unbundling
  - Combined or split risk margin
  - Lots more
- Contract boundaries
  - What to include, what not to
- Par business “orphan estate”
- Analysis of change
  - Lots of work, must be included in disclosures
- Disclosures
  - More information
- Knock-on impacts, eg pricing, M&A
- Explaining differences vs MCEV, Solvency II etc

SOCIETY OF ACTUARIES