Institute and Faculty of Actuaries

Yield Curve Construction and Implications for Asset-Liability Management

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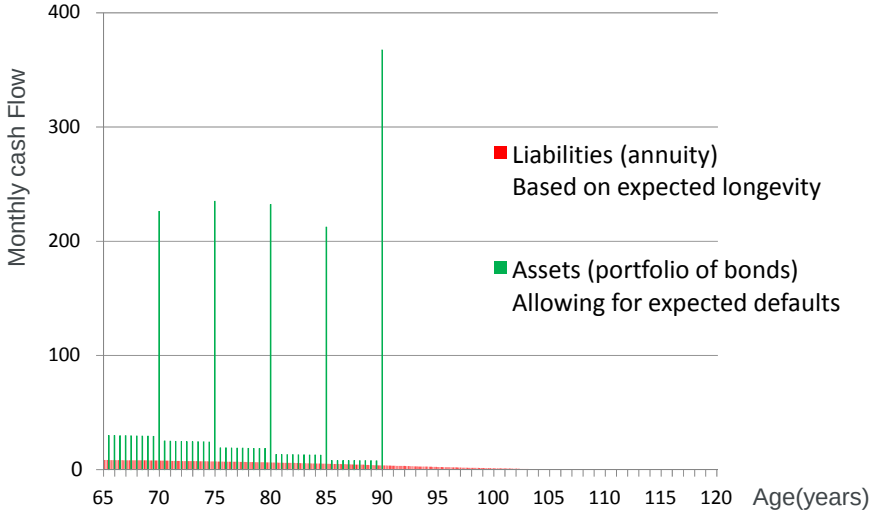
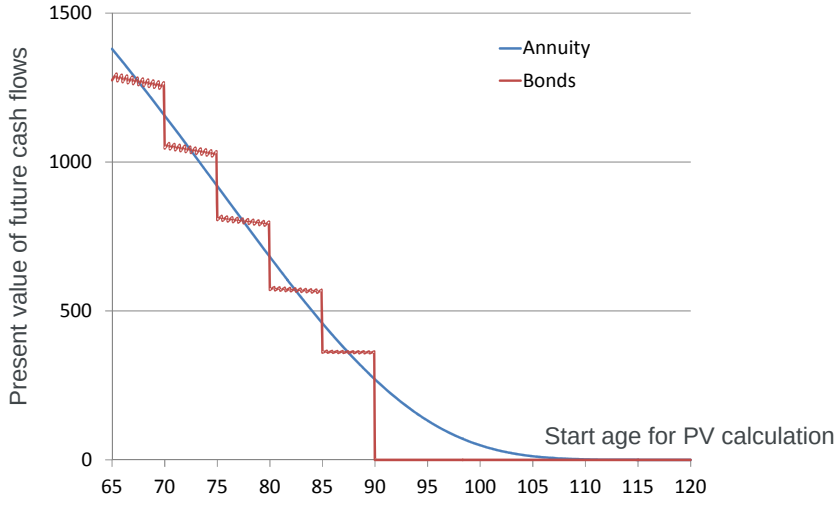
Cash Flow Matching - Reminder



Think of a Technical Discount Rate (for example, 4.2%)

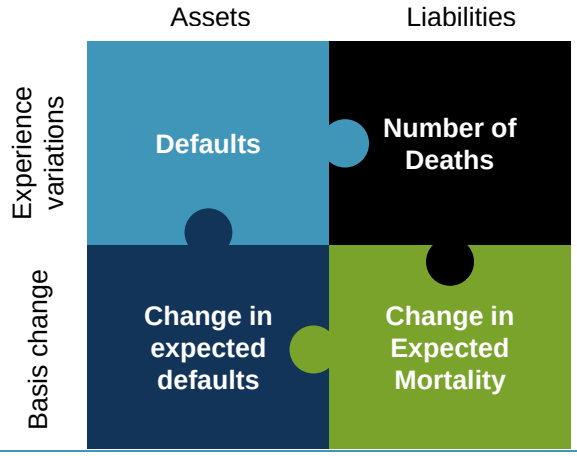


Analysing Cash Flows: Two Methods

- Method #1
  - We could try to match expected cash flows in buckets
  - But this suffers from arbitrary bucket boundaries
- Method #2
  - Choose a technical rate
  - Calculate PV of future flows at each future date
  - Minimise difference, for example by least sum of squares
- These calculations are cash flow based
  - No reference to market prices or yields

What if the cash flows change?

- With a one-year risk horizon, we worry about:



What about market value? Two extremes

Traditional View

- Difficult to assess if assets are illiquid, trading affects the price, trades are infrequent or not public
- Impossible to assess for liabilities because no market in actuarial decrements
- Only matters if you're buying or selling, while the whole point of cash flow matching is to avoid this.

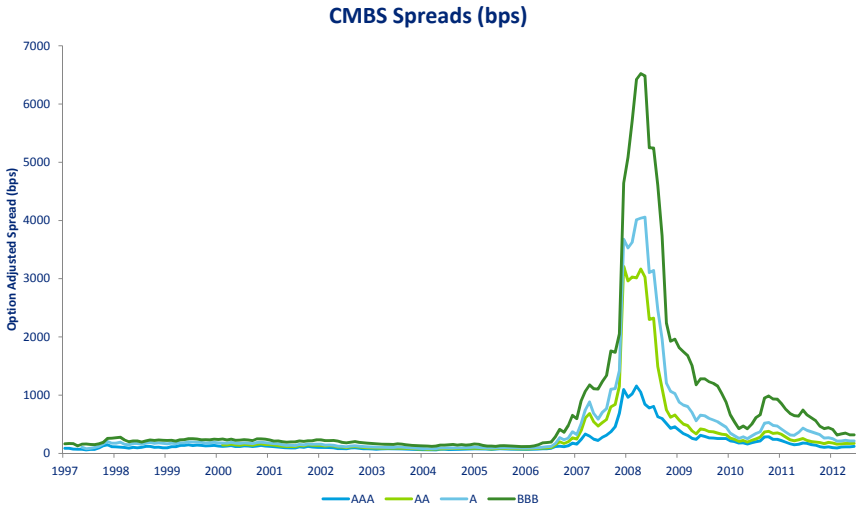
Market Consistent View

- Must put a market value for all cash flows, marking to model if no quoted price.
- Changes in market prices imply changes in cash flow expectations
- Balance sheet is more volatile in the market view than the traditional view, although matching alleviates this

As it turns out …

- The market price of the least-squares matching portfolio
- Is the same as the PV liabilities
  - Discounted using the Smith-Wilson formula
  - As used for interpolation / extrapolation for Solvency II
  - With the UFR equal to the technical rate
- It should all hang together so nicely!
- Except that we often calibrate our reference curves to different assets from those held (mostly swaps for S2)
- Therefore the spread between assets held and reference curves creates challenges for ALM

2008: Spreads Suddenly Interesting



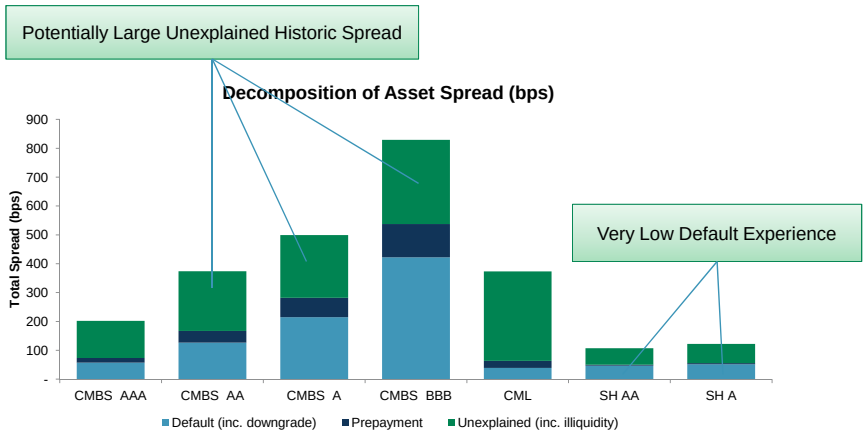
Regulatory Approaches

Solvency I	Solvency II
Liability Discount Rate 97.5% risk adjusted yield	**Liability Discount Rate** Risk-free (based on swaps) + "matching premium"

	Matching Premium Criteria
	• Must not have borrower options
	• Rated (BBB or higher)
	• Must be ring-fenced:
	  • Cannot be actively traded
	  • Diversification with other business not recognised

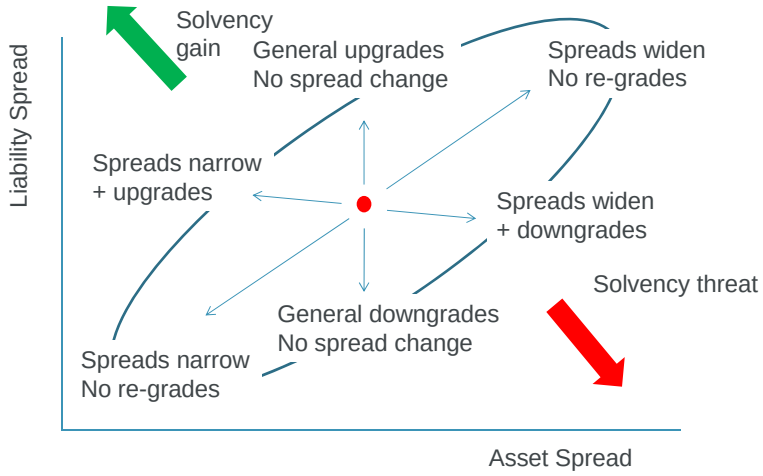
	Globally Significant Insurers Liquidity risk is a key consideration for globally significant insurers driving requirements to prepare risk and recovery planning material.

Illustrative Comparison of Asset Classes

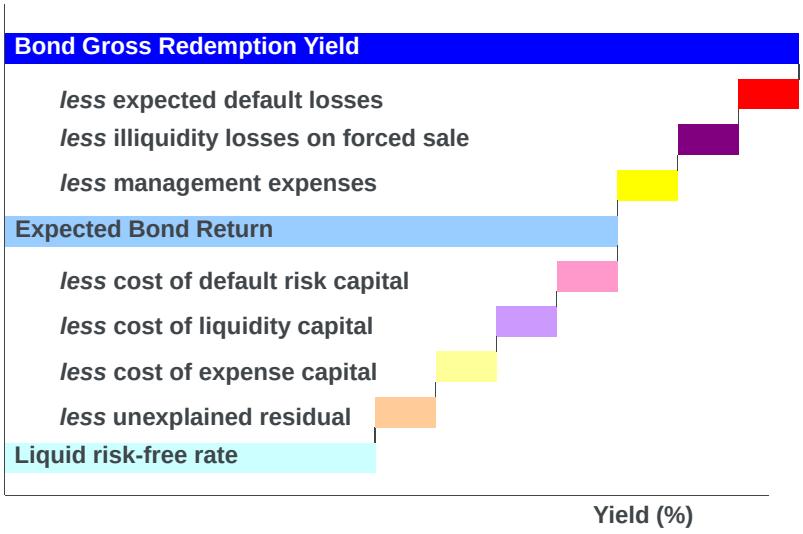


The matching premium compromise is that not all the spread is taken to imply lower expected cash flows.

Aspects of Asset-Liability Matching if Liability Spread Restricted by Grade



Spreads are made of Many Elements



Do Not Ignore Illiquidity Cost

Policy drivers

- Catastrophe insurance payout requires liquidity
- Loss of confidence/adverse publicity triggers surrenders
- No MVA dates cause concentration in withdrawals
- Embedded options moneyness cause concentration in withdrawals
- New product launches trigger surrenders/churn
- Optional additional premiums reduce unexpectedly

Market drivers

- Delta and other guarantee hedging requires triggers portfolio rebalancing
- Hedge rollover requires liquidity
- Limits on group fungibility trigger the need to move assets
- Derivative delivery requires liquidity
- Collateral posting on derivatives requires liquidity

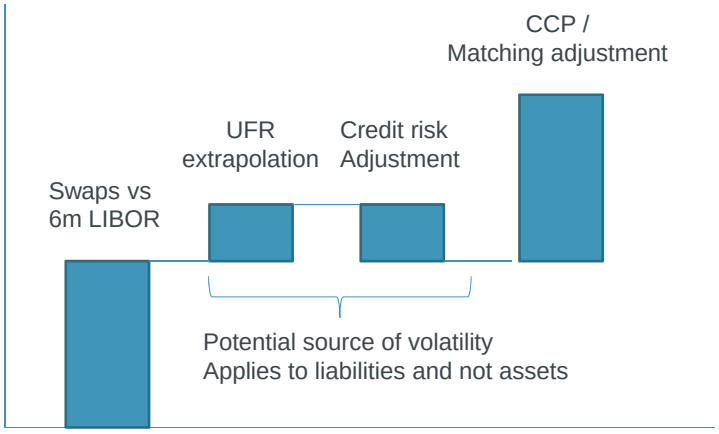
Credit drivers

- Downgrades effect on
  - Investment risk appetite
  - Collateral quality
  - Tracking an index
- Accelerated settlement / collateral liquidation through counterparty failures

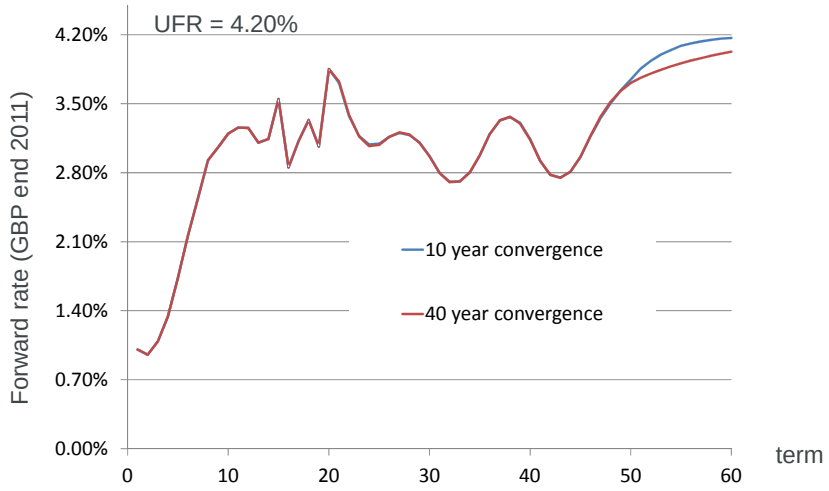
Financing drivers

- Debt coupons / principal payments require liquidity
- Merger / acquisition finance requires liquidity
- Collateral payments on securitisation require liquidity

Elements of Reference Curve under S2



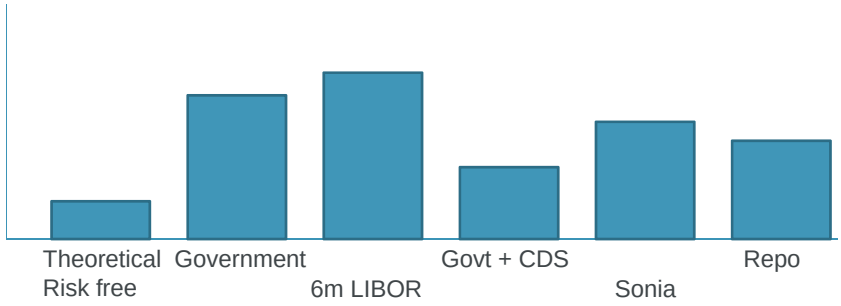
Extrapolation: LLP and UFR Convergence



ALM Impact of LLP and UFR

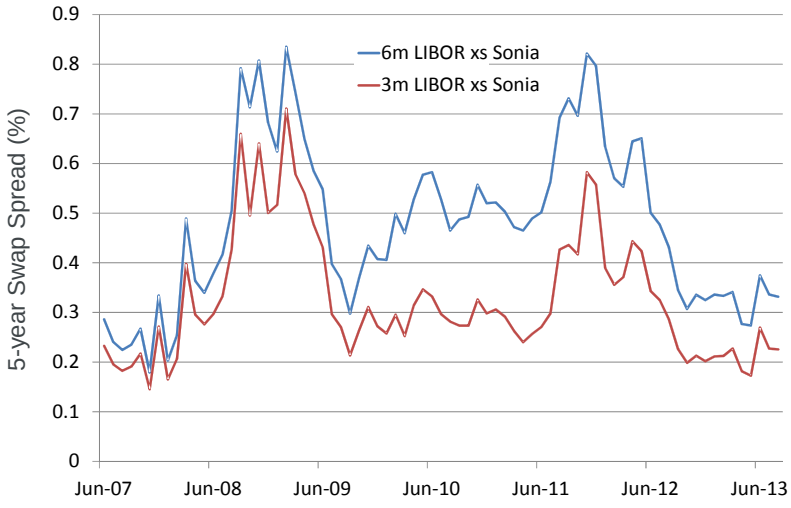
- Extrapolation is necessary when liabilities are longer than available assets
- However, in the euro zone for Solvency II there is a lot of pressure to start extrapolation early (for example, from Last Liquid Point = 20 years) even where longer asset quotes are available.
- This currently reduces stated euro liabilities (because the ultimate forward rate of 4.2% is higher than market yields)
- Reduces balance sheet volatility if liabilities are longer than assets, but exacerbates volatility if you match with long assets
- Compared to S2, IFRS is less forgiving of ignoring market prices

Benchmarking to a “Risk Free” curve

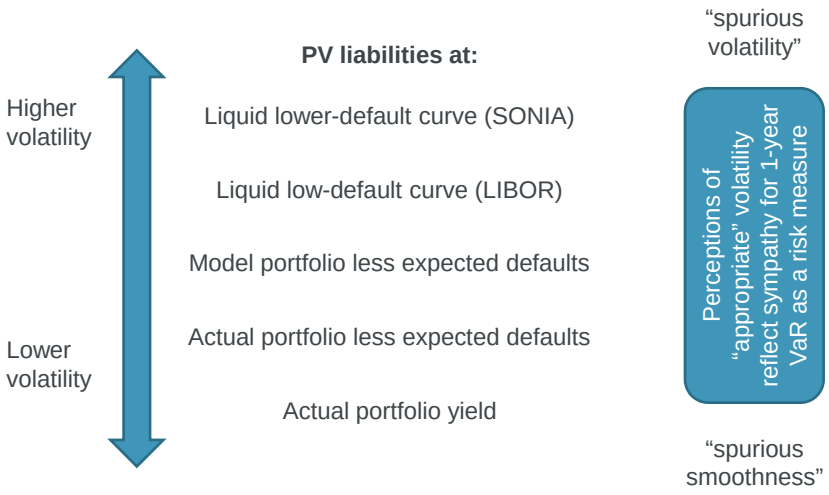


There is no default-free asset. The best we can do is use spreads to convert from one degree of credit risk to another

Credit Risk Adjustment Impact



Impacts of Discount Choices on 1-Year Value-at-Risk for CF Match



Conclusions

- In our regulatory environment, there is an inevitable focus on one-year VaR
- You do not have to manage your business this way unless you are especially capital constrained
- Longer term metrics are more congenial to management of long term liabilities
- But it's a challenge to communicate this to stakeholders who are naturally drawn to 1-year RORAC measures
- Some firms have an appetite for longer term liquidity risk and others do not. The key is keeping investors on board.

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 and not necessarily his employer nor the IFoA.

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