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The Unhedgeables

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Agenda

- Introduction
- Case Studies
  - Rates
  - Inflation
  - Property
  - Longevity
- Conclusions

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Unhedgeables in Solvency II

- *The RM "is intended to capture 'non-hedgeable risks' , such as longevity",*

  Sam Woods, November 2015
- DA, Article 138: RM includes
  - *i. underwriting risks*
  - *ii. credit risks*
  - *iii. operational risks*
  - *iv. where material, market risk, other than interest rate risk, assuming assets are selected to minimise market risk*

$$RM = CoC \sum_i SCR_i \, . df_i$$

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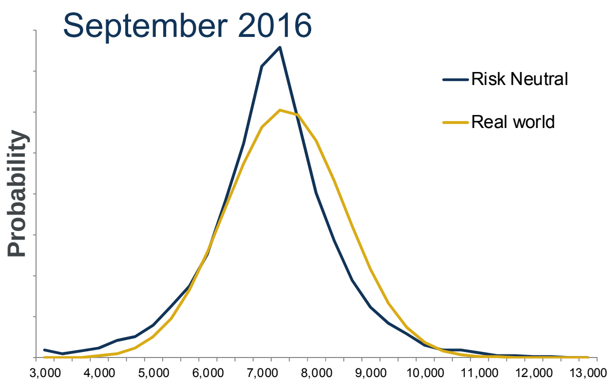
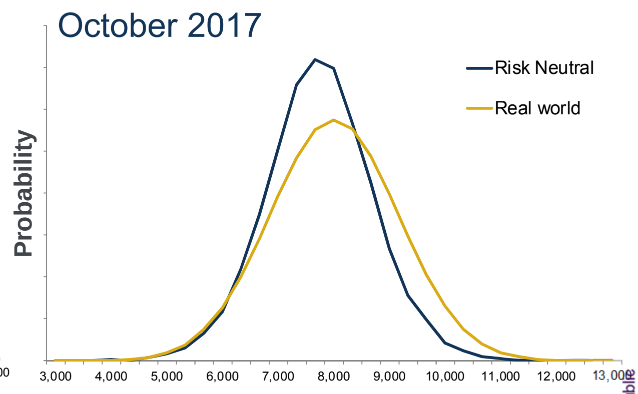
Equity | Risk Neutral vs Real World





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Deep, liquid & transparent market. Fat tails

Real world may be more static, contain a risk premium

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Case Studies

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Market Risk | EIOPA Consultation

- Don't link CoC to IG credit spreads – should reflect equity & non-senior debt
- CoC should be **higher** than 6%
- No justification for:
  - Adding a rate component
  - Varying with rate level
  - Capping at 100% SCR
  - Scaling through time
- **Market risk should be included but…**

$$RM = CoC \sum_{i} SCR_i \, . \, df_i$$

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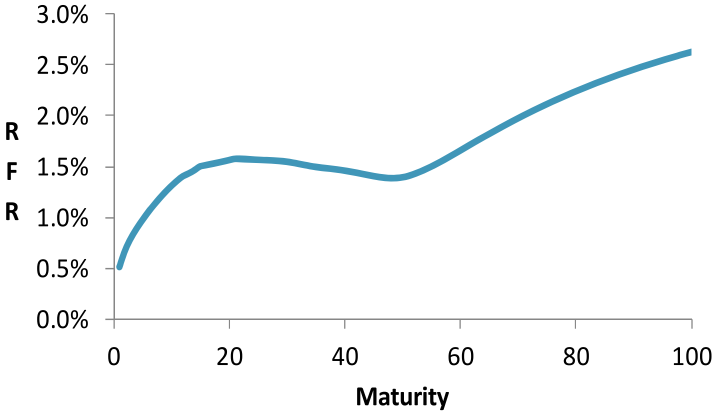
Rates | UFR

- Hedging beyond 50Y
- Delta of points > 50Y
- Slope at 49Y/50Y
- Roll down



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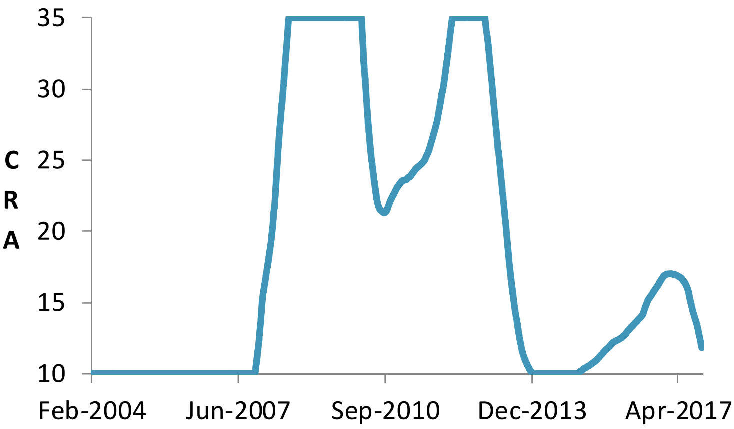
Rates | CRA

- 12M Averaging
- 6M Spread
- Capped
- Floored



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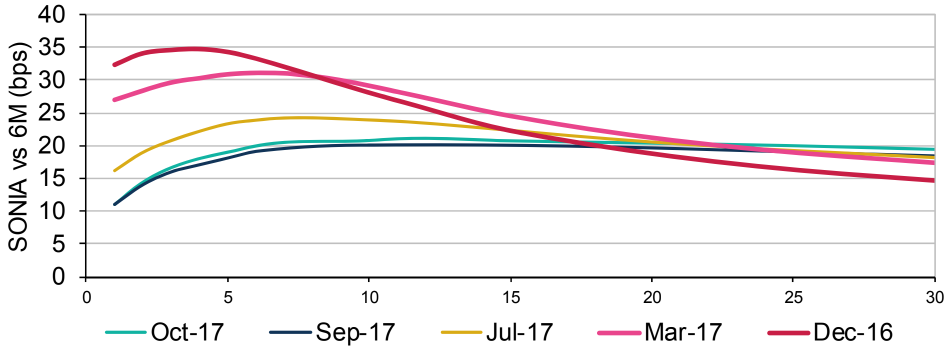
Rates | Sonia Benchmark Risk-Free Rate

- Reformed SONIA preferred RFR
- Official sponsorship of LIBOR ends in 2021



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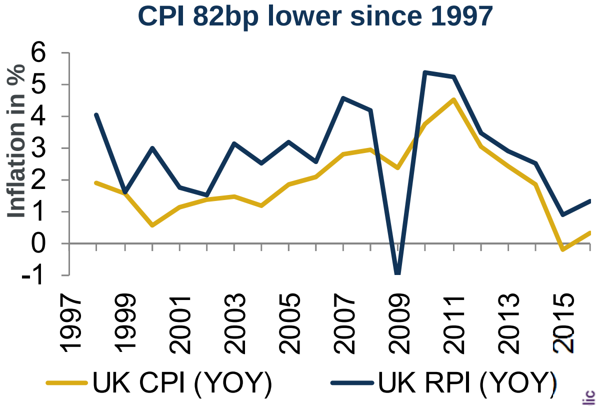
Inflation | CPI

- Common in deferred annuities
- High / Low inflation:
  - → wide / narrow RPI/CPI wedge
  - → Vol used in LPI not the same for CPI as RPI



- Increase in available CPI assets
  - – Regulatory change to utilities => increased supply
- Increased demand?

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Inflation | LPI Case Study

- Phoenix acquired first LPI linked liabilities
  - via buy-in of pension scheme
- Liability LPI linkage defined:

$$\prod_{i=0}^{t}\left[1+max\left(min\left\{\frac{I(t)}{I(t-1)}-1, cap\%\right\}, floor\%\right)\right]$$

- Such structures are path dependent
- Valuation would require modelling of the entire inflation term structures

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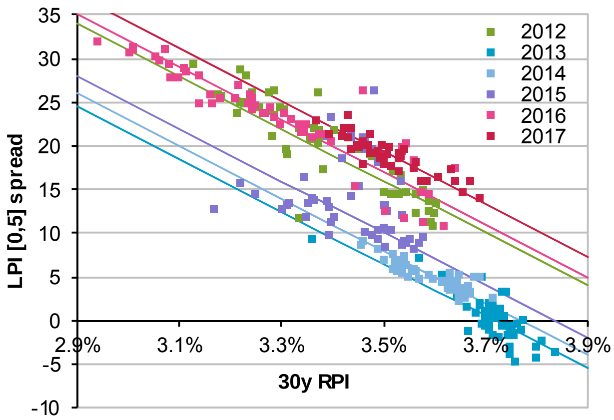
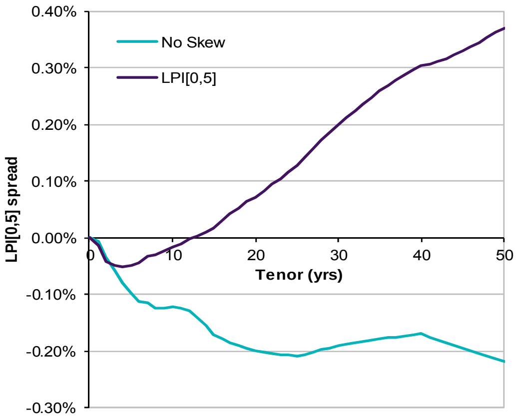
Inflation | LPI Case Study





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Inflation | LPI Case Study

Hull White (2 factor) within Jarrow Yildirim
- One potentially suitable no arbitrage model Phoenix initially considered
- **PROs:** Time dependent parameters allow fitting to co-related nominal and inflation term structures and capture LPI path dependency
- **CONs:** 5 parameters to calibrate, only one of which directly related to inflation. No analytic pricing

SABR
- Popular model amongst LPI market participants
- **PROs:** Tractable stochastic volatility model capable of fitting smile well
- **CONs:** Not a term structure model so incapable of handling path dependency

- Calibration to empirical "pseudo-market"

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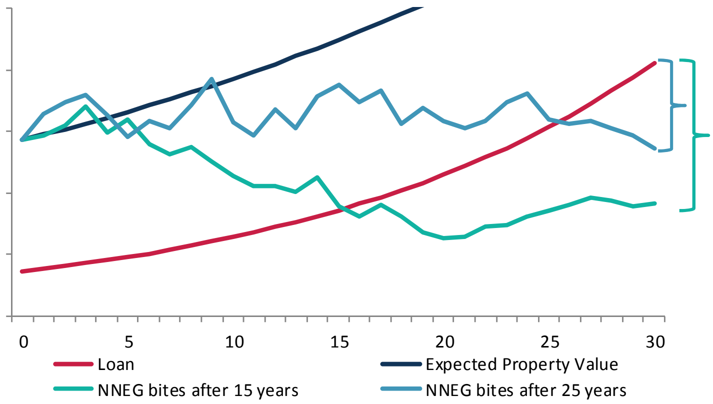
Property | ERM NNEG



NNEG
- No Negative Equity Guarantee
- Hedge with Property Derivatives?

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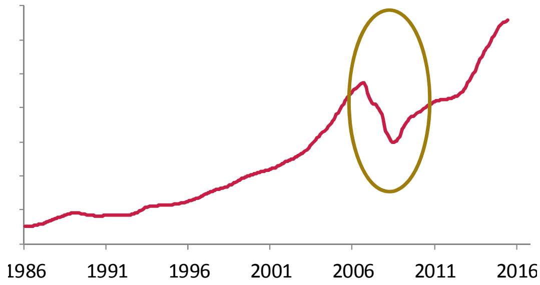
Property | NNEG Case Study

- House price curve projected by blending
  - Short: market forecasts (e.g. OBR)
  - Medium: national average earnings
  - Long: RPI linkage
- Black Scholes NNEG valuation
- Empirical model input volatility



- Internal model consistent stresses and simulation for capital

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Longevity | Is it hedgeable?

- SII perspective → strictly no
- Commercial reality → potentially
  - Active and Competitive market
    - ➢Phoenix has £13bn gross longevity exposure, of which we hedge ~55%
  - Relatively short transaction lead time

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Longevity | Is it hedgeable?

- Clear market segmentation: immediates vs deferreds
- Bespoke contracts
- Lack of secondary market
- Counterparty risk
  - Depends on collateral quality / frequency of posting
  - Secondary liquidity drag and risk of large moves

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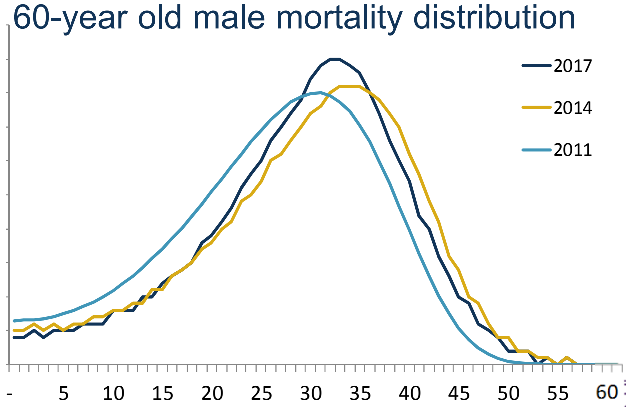
Longevity | Potential Future developments

- Pass-through arrangements and/or captives?
- Comeback for index-based solutions?

60-year old male mortality distribution



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Non-Market Risk | EIOPA Consultation

- Allowing for hedgeability of longevity risk
  - "It is not clear why the reference undertaking should apply more (or less) risk-mitigation than the original undertaking."
- Alternatives to EIOPA / SII:
  - Current IFRS – addition of prudence, not RM
  - IFRS 17 – what should RM look like?

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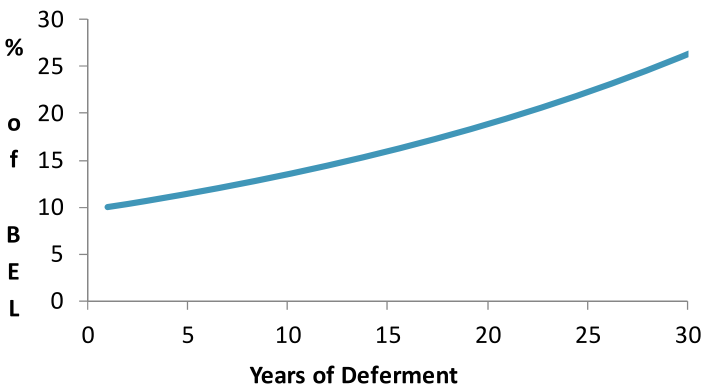
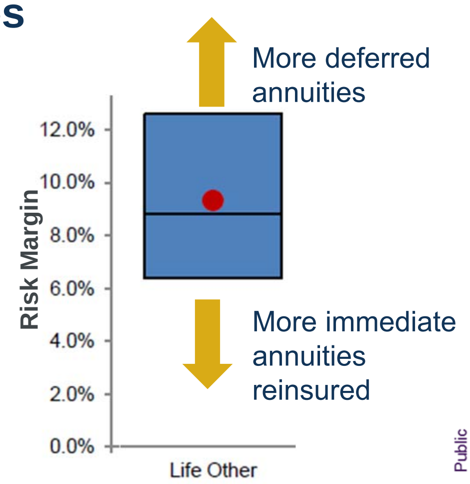
Longevity | Deferreds vs immediates





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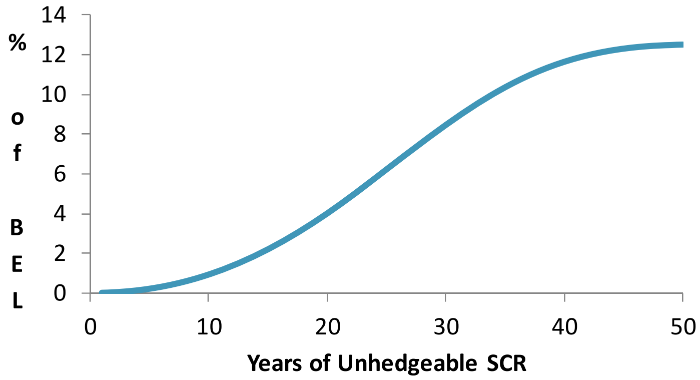
http://www.bankofengland.co.uk/pra/Documents/publications/reports/idr181017.pdf

Longevity | How long to hedge / reinsure?



$$RM = 6\% \sum_i SCR_i \,.\, df_i$$

$$SCR_i \approx \sum_{j>i} K_j . \frac{df_j}{df_i}$$

$$RM \approx 6\% \sum_i \sum_{j>i} K_j . df_{j_i}$$

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Conclusions

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Summary

	Solvency II	Economically	Future?
UFR			
CRA			
CPI			
LPI			
Property			
Longevity			

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Questions

Comments

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