

# The Global Longevity Risk Transfer Market

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# Agenda

- Background
- Successful longevity risk management solutions
- Index vs customized hedges
- Mortality models and their applications
- Developments in the in the longevity risk transfer market since 2006
- A look into the future: Potential longevity risk transfer solutions
- Conclusions



# Background

# Background

- Longevity risk transfer market started in UK in 2006
  - Now a global market
- At the time, capital market solutions were expected to dominate
  - Swiss Re Vita mortality bond issued in 2003
    - Subsequent volumes of mortality bonds low
  - EIB/BNP Paribas longevity bond announced in 2004
    - Insufficient demand to launch
- But insurance-based solutions dominated



# Quantifying the potential size of the longevity risk market

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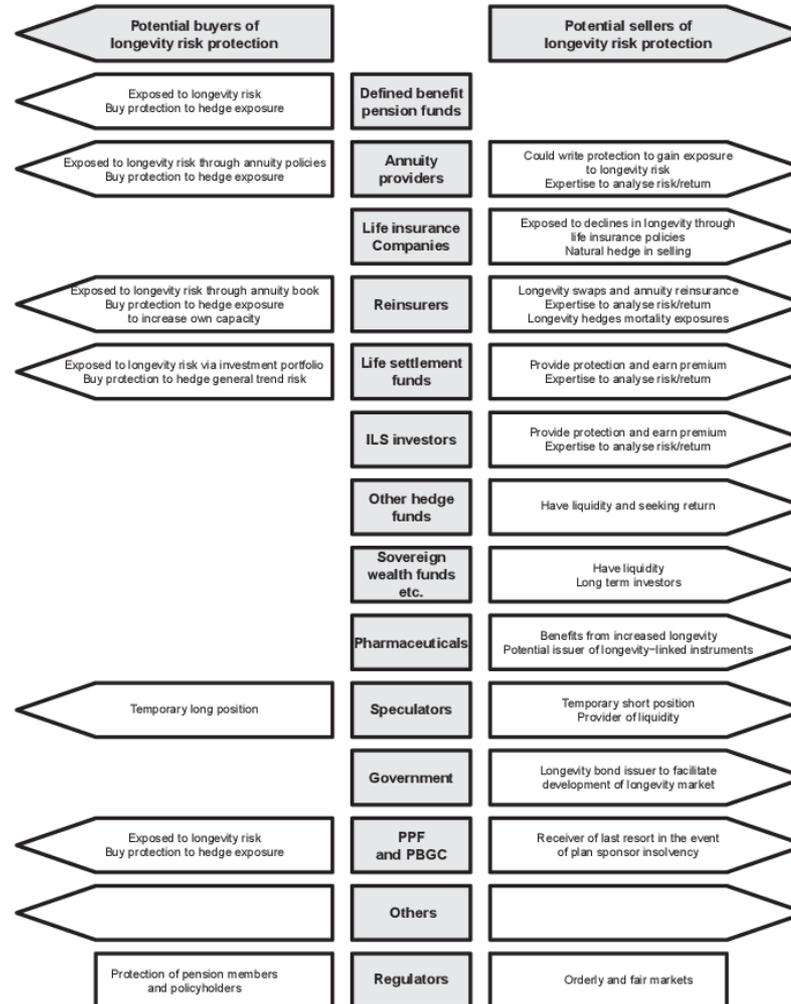
- Potential size of the global longevity risk market for (state and private sector) pension liabilities at between \$60trn and \$80trn
- Main countries (private sector):
  - US (\$14.460trn)
  - UK (\$2.685trn)
  - Australia (\$1.639trn)
  - Canada (\$1.298trn)
  - Holland (\$1.282trn)
  - Japan (\$1.221trn)
  - Switzerland (\$0.788trn)

# Quantifying the potential size of the longevity risk market

- Only UK, US, Canada and Holland currently have the conditions for a longevity risk transfer market to develop
- These conditions include:
  - low interest rates which, by increasing the PV of more distant pension payments, has exposed the real extent of longevity risk in pension plans
  - inflation uplifting of pensions in payment (UK, Holland)
  - frequent updating by the actuarial profession of longevity projections
  - introduction of market-consistent valuation methods
  - increased accounting transparency of pension assets and liabilities
  - increased intervention powers by the regulator



# Stakeholders in the longevity risk transfer market





# Successful insurance- based solutions

## Successful insurance-based solutions

- Classified as ‘customized indemnification solutions’
  - since the insurer fully indemnifies the hedger against its specific risk exposure
- These solutions can also be thought of as ‘at-the-money’ hedges
  - since the hedge provider is responsible for any increase in the liability above the current best estimate assumption on a dollar-for-dollar basis

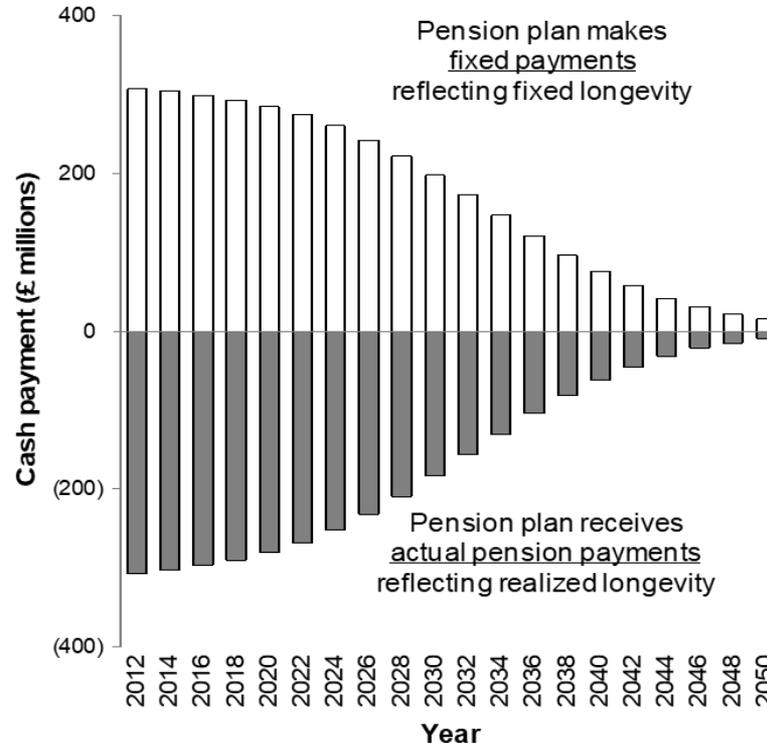


# Successful insurance-based solutions

- ***Buy-out***
  - Also known as pension termination or group/bulk annuity transfer
- ***Buy-in***
  - Bulk purchase of annuities by pension plan to hedge risks associated with a subset of the plan's liabilities
    - typically associated with retired members.
  - The annuities become an asset of the plan and reflect the mortality characteristics of the plan's membership in terms of age, gender and pension amount
    - but are not written in the names of specific plan members

# Successful insurance-based solutions

- **Longevity insurance contract or insurance-based longevity swap**





# Successful capital markets solutions

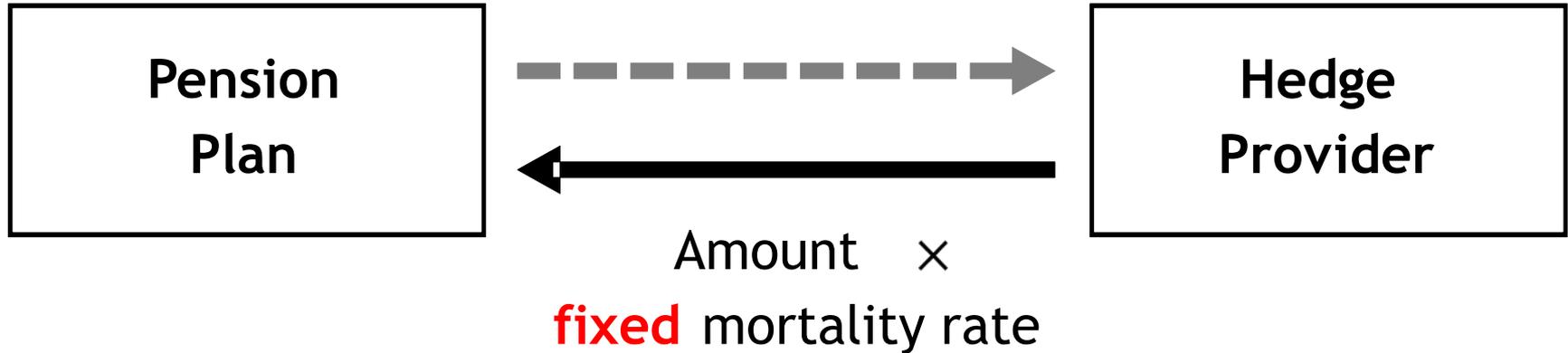
# Successful capital markets solutions

- Small number of capital market securities have been successfully launched since 2006:
  - longevity-spread bond (Kortis, 2010)
  - longevity swap
  - $q$ -forward
  - tail-risk protection (or longevity bull call spreads)
- Key feature of these is that most are index rather than customized solutions

# Successful capital markets solutions

*q-forward or mortality forward*

Amount  $\times$   
**realized** mortality rate



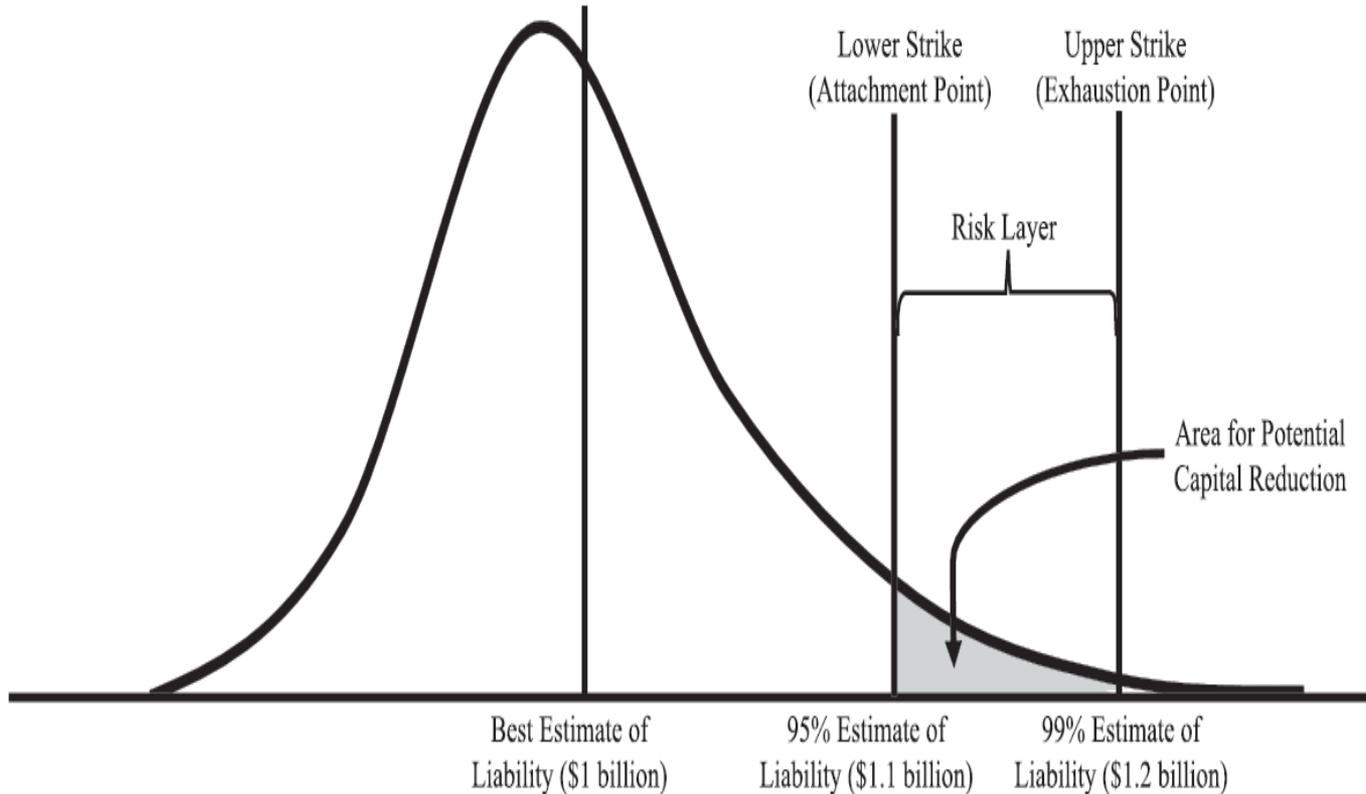
A *q-forward* exchanges fixed mortality for realized mortality at the maturity of the contract



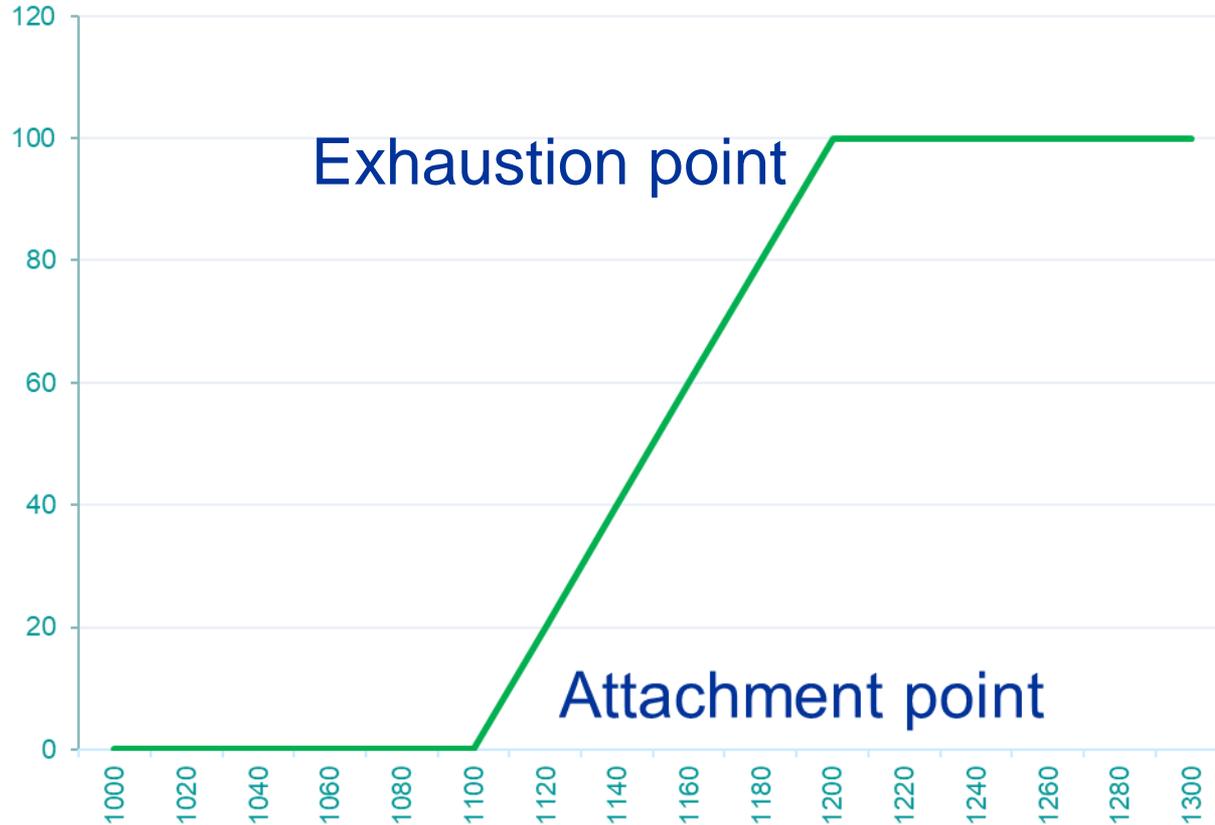
# Successful capital markets solutions

- ***Tail-risk protection (or longevity bull call spread)***
- Five publicly announced deals to date:
  - Two involved Aegon:
    - one in 2012 was executed by Deutsche Bank
    - another in 2013 by Société Générale.
  - Two involved Delta Lloyd and Reinsurance Group of America (RGA Re) in 2014 and 2015
  - Most recent occurred in December 2017 between NN Life and Hannover Re
- Deep 'out-of-the-money' hedge
  - Constructed using a long call at the lower strike price and a short call at the upper strike price

# Distribution of Final Index Value and Potential for Capital Reduction



# Bull call spread payoff to hedger



# Successful capital markets solutions

- Société Générale deal:
  - Given the distribution of the final index, the attachment and exhaustion points are selected to maximize the hedger's capital relief
  - Hedger needs to calculate the level of capital required to cover possible longevity outcomes with a specified degree of confidence. E.g.
    - 'best estimate' of the longevity liability is \$1bn
    - 99% confidence level is \$1.2bn
    - implying \$200m of reserve capital needed



# Successful capital markets solutions

- Société Générale deal:
  - Insurer decides to implement a hedge transaction with a maximum payout of \$100m
  - This transaction would begin making a payment to the hedger in the event the attachment point is breached, and then pay linearly up to \$100m if the longevity outcome meets or exceeds the exhaustion point
  - This hedge provides a form of ‘contingent capital’ from investors (up to \$100m of the \$200m required), enabling the hedger to reduce the amount of regulatory capital it must hold.



# Index vs customized hedges

# Index vs customized hedges

## Advantages

## Disadvantages

### Standardized index hedge

- Cheaper than customized hedges
- Lower set-up/operational costs
- Shorter maturity, so lower counterparty credit exposure

- Not a perfect hedge:
  - Basis risk
  - Roll risk
  - Base table estimation risk

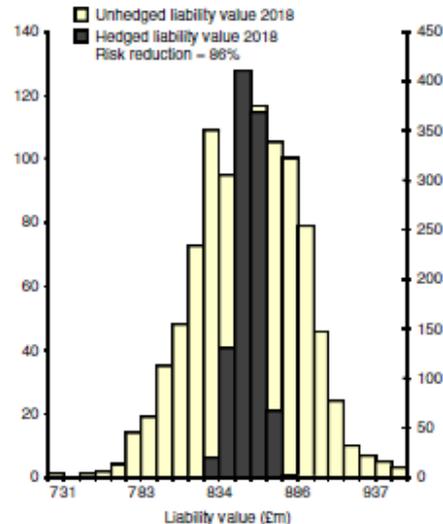
### Customized hedge

- Exact hedge, so no residual basis risk
- Set-and-forget hedge, requires minimal monitoring

- More expensive than standardized hedge
- High set-up and operational costs
- Poor liquidity
- Credit risk: Longer maturity, so larger counterparty credit exposure
- Less attractive to investors

# Index vs customized hedges

- Coughlan *et al.* (2007b) show that a liquid, hedge-effective market could be built around just eight standardized  $q$ -forward contracts with:
- a specific maturity (e.g., 10 years);
- two genders (male, female);
- four age buckets (50-59, 60-69, 70-79, 80-89).





# Mortality models

# Mortality models

- Mortality models play a critical role in the design and pricing of longevity solutions
- There are three classes of stochastic mortality model in use:
  - extrapolative or time series models
    - cannot capture change of trend immediately
  - process-based models
    - which examine the biomedical processes that lead to death
  - explanatory or causal models
    - which use information on factors which are believed to influence mortality rates such as
      - cohort (i.e., year of birth), socio-economic status, lifestyle, geographical location, housing, education, medical advances and infectious diseases.



# Mortality models – process-based and causal

- RMS Longevity Risk Model:
  - base model used to project mortality and variations in mortality during normal conditions when there are no extreme mortality events.
- Projections depend on 5 'vitality categories' or individual sources of mortality improvement:
  - lifestyle trends, including smoking prevalence
  - health environment
  - medical intervention
  - regenerative medicine
    - such as stem cell research, gene therapy and nanomedicine
  - retardation of ageing
    - including telomere shortening and caloric restriction.

# Mortality models – process-based and causal

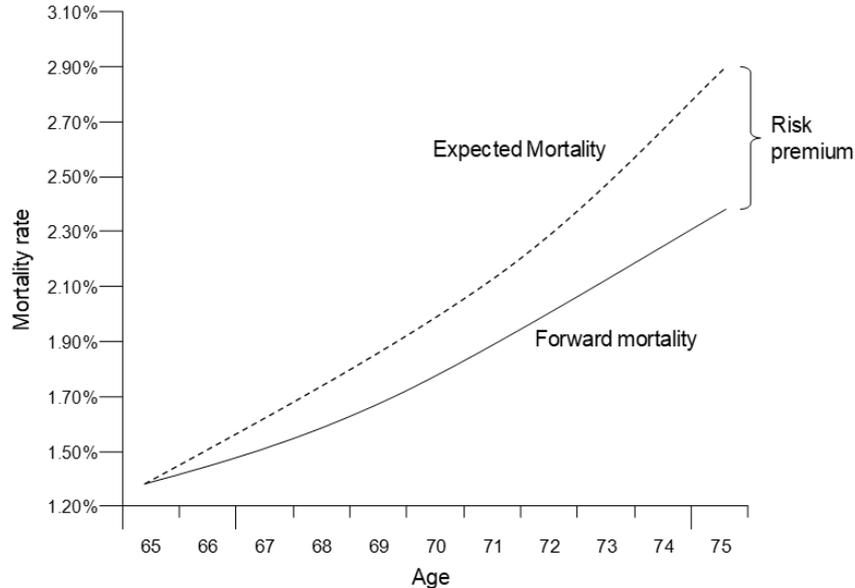
- Club Vita:
  - UK longevity data and analytics company set up to improve socio-economic modelling of mortality data
    - allowing the segmentation of projections by SEC
- To illustrate, cancer mortality related to
  - smoking (lung) is more commonly associated with the lowest SEC
  - sun exposure (malignant melanoma) is more commonly associated with the highest SEC
- Segmented longevity trend models have improved in recent years due to:
  - new insights from medical science
  - greater understanding of cause of death for each SEC



# Applications of the mortality models

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- ***Determining the longevity risk premium***



Note: Lines are illustrative only

Source: Adapted from Loeyes et al. (2007, Chart 9)

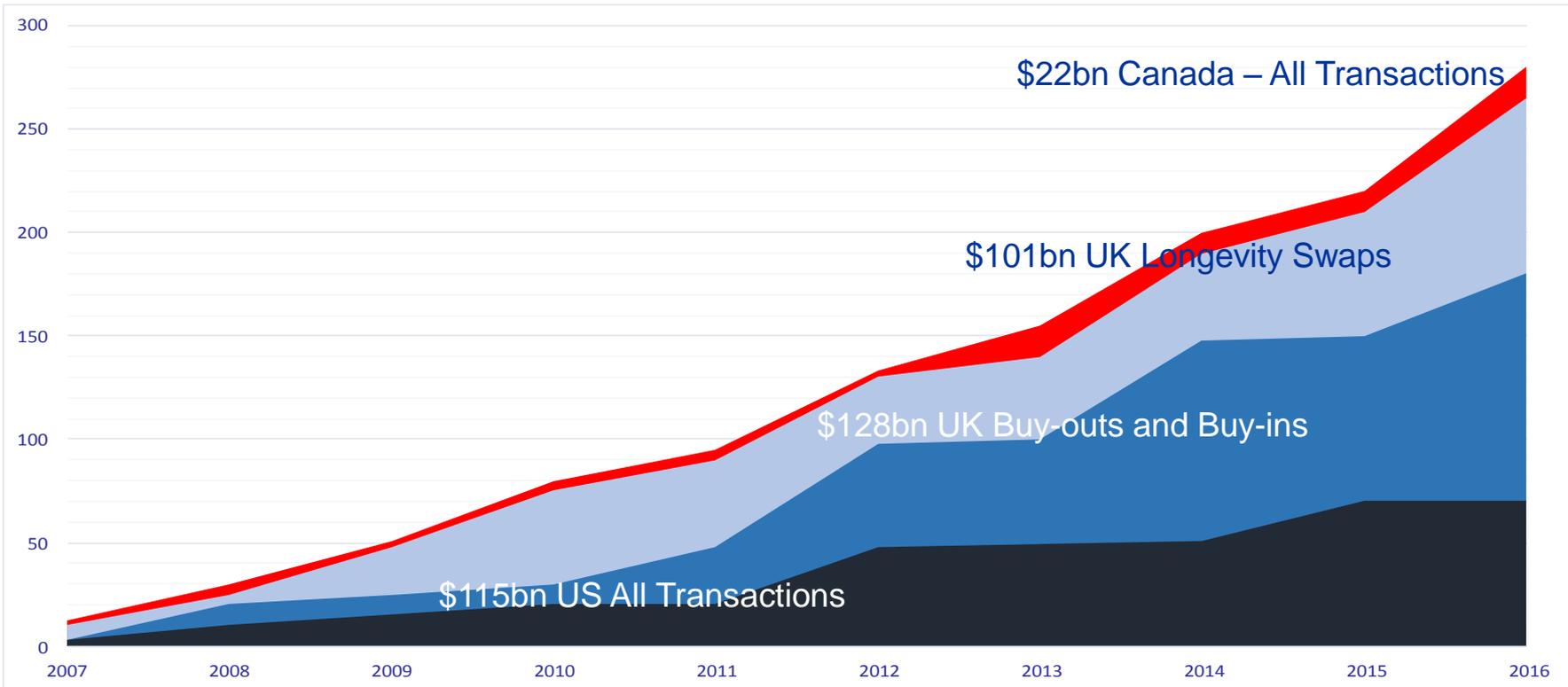
- ***Estimating regulatory capital relief***



# Developments in the in the longevity risk transfer market since 2006



# Cumulative pension risk transfers by product and country, 2007-17 (\$366bn)



# Innovation is a continuing feature of this market

- Buy-ins and buy-outs with deferred premium payments
- Phased de-risking using sequence of partial buy-ins
  - with 'umbrella' structure to avoid more than one set of contract negotiations
- Accelerated buy-ins
  - insurer provides loan to the plan equal to the deficit
    - so that partial buy-in can take place immediately
  - with this converting to a full buy-in when the loan has been repaid
  - with the option of a full buy-out at a later date

# Innovation is a continuing feature of this market

- Forward start buy-ins
  - a standard buy-in with the start date delayed to reflect the level of funding available
- Automated bulk plan transfers
  - introduced in November 2017 by Scottish Widows and Standard Life
  - to reduce risks
- Top-slice buy-ins
  - to target the highest value liabilities

# Innovation is a continuing feature of this market

- Novation
  - ability to transfer a longevity hedge from one provider to another, thereby introducing some liquidity into what had previously been a completely illiquid market.
    - e.g., reinsurance of a small bulk annuity transaction
- Longevity swap to buy-in conversions
  - as pioneered by Phoenix Life in December 2016
- Insuring away the extreme tail of liabilities in a closed plan after a specified term, e.g., 5 or 10 years



# **A look into the future: Potential longevity risk transfer solutions**

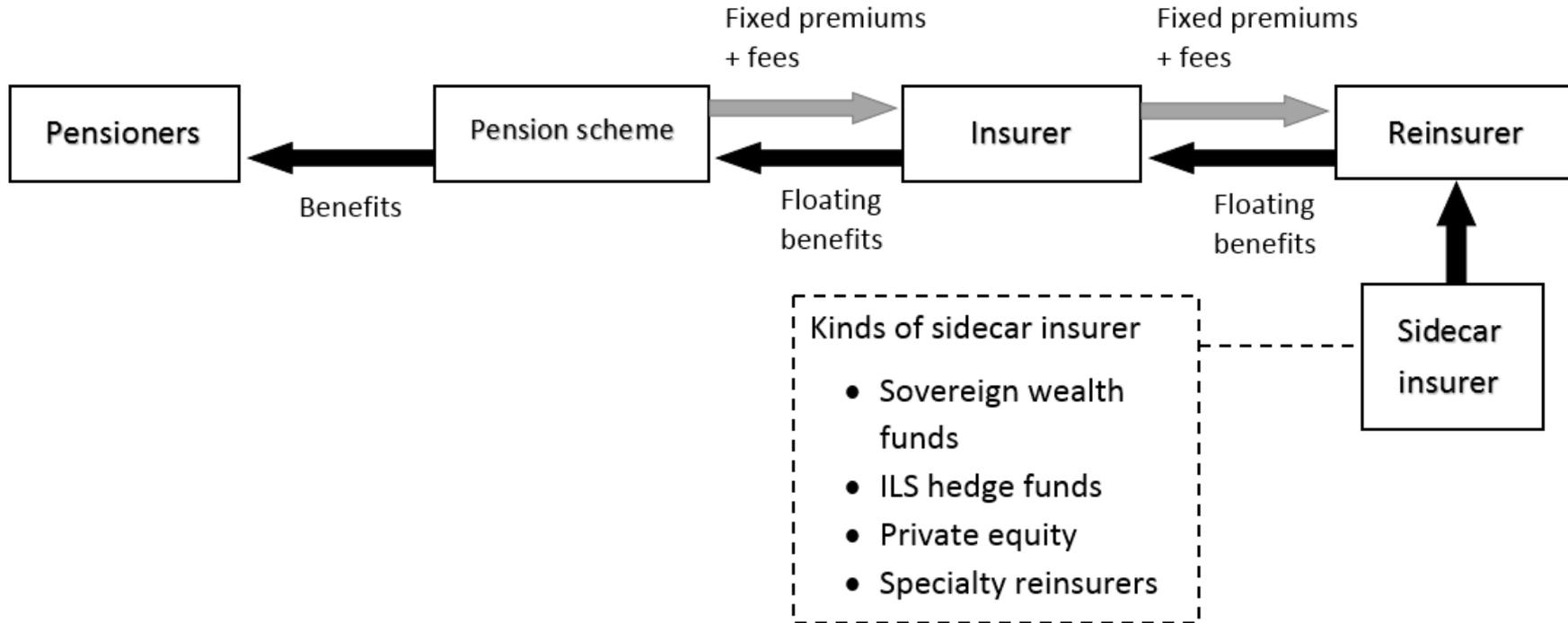
## A look into the future: Potential longevity risk transfer solutions

- ***Potential new solution: Longevity-linked securities***
- A perceived problem with the EIB/BNP Paribas longevity bond was that the reference index might not be sufficiently highly correlated with a hedger's own mortality experience (as a result of population basis risk).
- A longevity-linked security (LLS) deals, at least partly, with this problem.
- The concept was inspired by the design of mortgage-backed securities.

## A look into the future: Potential longevity risk transfer solutions

- ***Potential new solution: Re-insurance sidecars***
- Financial structure established to allow external investors to take on the risk and benefit from the return of specific books of insurance or reinsurance business.
- It is typically set up by:
  - existing re-insurers that are looking to either partner with another source of capital
  - an entity to enable re-insurers to accept capital from third-party investors
- RGA Re and RenaissanceRe set up Langhorne Re in 2018 to target in-force life and annuity business

# Typical sidecar structure





# Conclusions



## Conclusions

- Longevity risk inherent in the world's aggregate retirement obligations far exceeds the amount of risk capital the global insurance industry can realistically bring to bear against this risk
  - Total global reinsurer capital was just \$595bn at 31 December 2016
- Vast sums of additional risk capital must be introduced to manage longevity risk
- Can *only* come from the global capital markets

## Conclusions: Four major challenges

- **(1) Currently, long-term investors prefer bonds, but most successful solutions to date for hedging longevity risk have been via longevity swaps**
- Short-term mortality bonds have been a success, but not long-term longevity bonds so far
- However, the Swiss Re strategy of gradual iteration from a successful innovation is a good way forward:
  - as exemplified by Kortis longevity spread bond which was a modest adaptation of the Vita mortality bond
- Two key prizes: much bigger investor base and much greater market liquidity

## Conclusions: Four major challenges

- **(2) Needs to be a common agreement between market participants on which mortality model to use for the design and pricing of longevity-linked solutions**
- One of the main reasons why Aegon's deal with Société Générale went ahead in 2013 was that all parties agreed to use the same mortality model
- Even if a mortality model produces the wrong forecasts – which it is bound to do – as long as those forecasts are not systematically biased, then it becomes a potential candidate for use in this market

## Conclusions: Four major challenges

- (3) **A number of operational issues need to be dealt with:**
  - **basis risk, credit risk, collateral and liquidity**
- Requires:
  - market participants to work out the optimal trade-offs between basis risk and liquidity and between credit risk and collateral
  - regulator to be willing to grant fair levels of regulatory capital relief for index-based hedge solutions that are compatible with current solvency capital requirements and consistent with levels of capital relief for customized longevity hedges
- Thereby putting both types of hedge on a level footing

## Conclusions: Four major challenges

- **(4) It is important to engage with the regulator.**
- Key message of Richard Sandor when he spoke at the *Longevity 12* conference in September 2016
  - serial starter of new markets, such as the financial futures, climate exchange and Ameribor markets
- He said that he always worked closely with the regulator when he was introducing a new product or market, so that there would be no surprises on the launch date
- Failure to do this in the case of the early Dutch tail-risk protection deals meant that the regulator did not give the capital relief that was anticipated at the design stage

## Conclusions

- These four challenges will need to be addressed in the next stage of the development of this market
- But innovation has been an important feature of the longevity market since 2006 and there is every reason to believe that this will continue as the different players in the industry seek to:
  - reduce costs
  - optimize capital and
  - manage risks



# Thank you!