



Swiss Re

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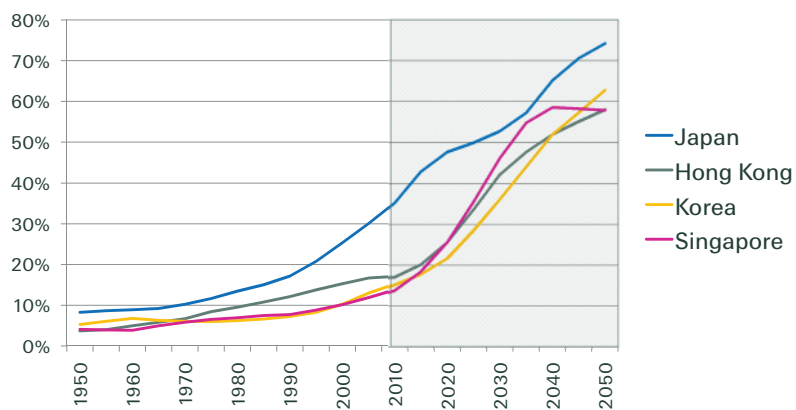
Living longer and longer

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More older people...

Old-Age Dependency Ratio (65+ vs 15-64)



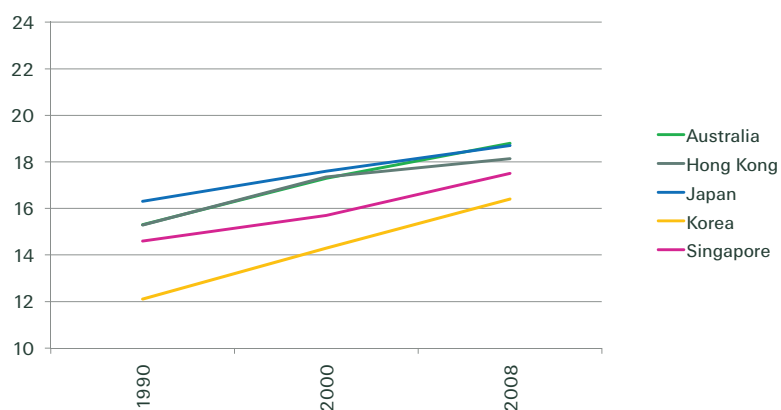
Source: UN - World Population Prospects: 2008 Revision

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Living longer and longer...

Life Expectancy at Age 65 - Males



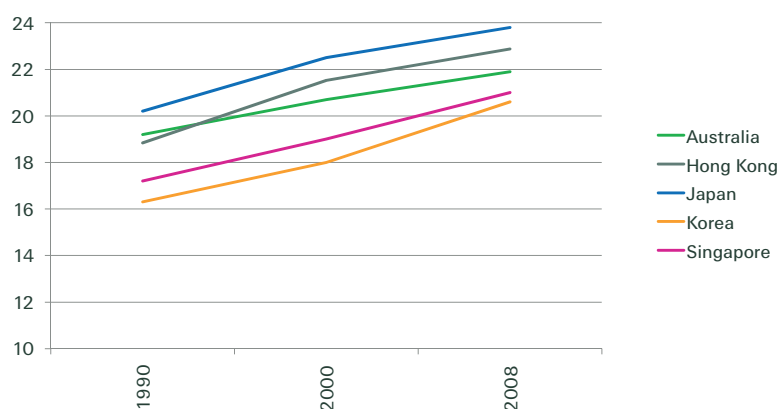
Source: UN – Life Tables for Member States 2010, HK Census & Statistics Dept

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Especially if you're a woman

Life Expectancy at Age 65 - Females



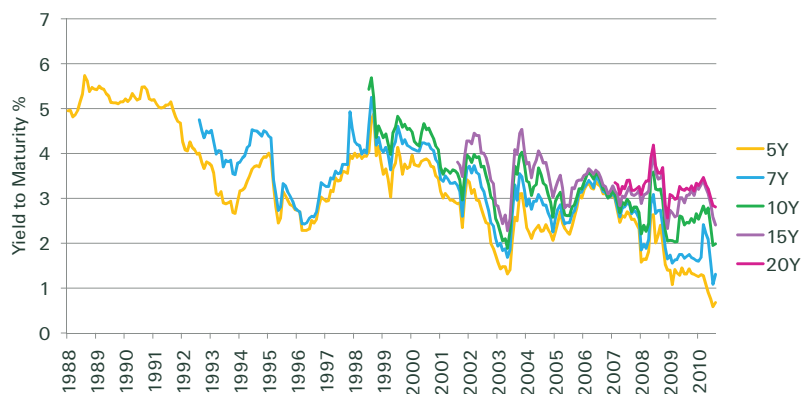
Source: UN – Life Tables for Member States 2010, HK Census & Statistics Dept

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Compound interest isn't what it used to be

Singapore Government Securities



Source: MAS – Financial Database

Living too long

■ Problems

- Smaller working age population supporting larger retired population
- Longer period spent in post-retirement years
- Very low interest rate environment
- Lower fertility rates and eroding cultural tradition of supporting parents in old age

■ But the problems won't become obvious for many years yet

■ Consequences

- Cannot rely on subsequent generations to fund retirement
- Need to save more for retirement than ever before or postpone retirement
- Need to save more or take greater investment risks
- Difficult to rely on the financial support of children

■ Difficult to get ordinary people to address these risks

Annuities – the customer perspective

Annuities – the customer perspective

- Having a regular income for life is attractive and desirable
- Those who already have lifetime pensions are not complaining
- BUT opportunity costs are a major barrier
 - Significant loss of liquidity / flexibility
 - Bequest motive
 - Perceived as bad value for money due to low implied yield (a perception sometimes reinforced by the life insurance industry!)
- Living too long is perceived as a good problem to have



Denial and procrastination

■ Denial

- Personal expectations about longevity are shaped by experience
- Today's generation saw their grandparents die in their 60s and their parents die in their 70s
- Do people imagine living to 90 and beyond?

■ Procrastination

- Money won't run out for 10 or 20 years so why do anything now?
- If the money starts running out, people can sell off assets or downgrade their lifestyle
- Hopefully children and family will be able to provide support
- Maybe the government will help
- Think about it later



Life expectancy by amateurs

■ University of Nottingham 2005 study

- Survey of 3,500 individuals of all ages
- On average, underestimated life expectancy by 4.6 to 6.0 years
- Females underestimated life expectancy by more than males
- Those buying pensions underestimated by less than those not buying

■ Society of Actuaries 2005 Risks and Process of Retirement Survey

- Survey of 602 adults, half pre-retirement, half post-retirement
- 60% underestimated life expectancy, 38% by 5+ years

■ Manulife Singapore 2007 Survey

- Survey of 450 Singaporeans aged 45+
- Estimated post-retirement life expectancy at 9-12 years (versus 17+ years based on government statistics)



Customer behaviour

- Annuities sell well where
 - It is mandatory to take some retirement savings in the form of an income stream
 - There are significant incentives or for annuity purchase
 - tax benefits
 - subsidies
 - unrealistic pricing assumptions
 - Interest rates are high, making annuities look like good value for money
 - Customers are not worried about insurer counterparty risk
- Annuities do not sell well
 - Everywhere else



Annuities – the (re)insurer perspective



Annuities – the (re)insurer perspective

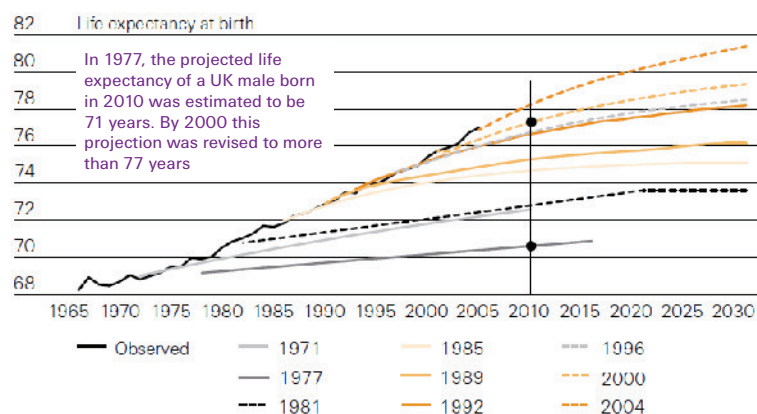
- People will live longer than they think
 - People are already living longer than insurers historically thought they would
- People who think they will live longer buy annuities
 - Self-selection in a voluntary market makes longevity more difficult to estimate
- Forecasting longevity is difficult, primarily because of trend risk
 - Trend risk is systematic / difficult to diversify
 - Trend deviations take a very long time to recognise – an insurer may have written a large portfolio before realising that trend assumptions were wrong
- Longevity is a very long duration risk
 - Difficult to find financial instruments with matching durations
 - Market consistent valuation methods imply that any investment return guarantee exceeding risk-free rates have a significant cost

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Life expectancy by experts



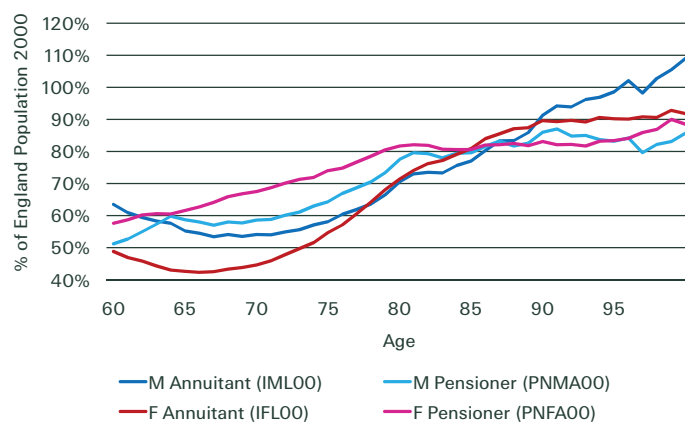
Source: Chris Shaw, "Fifty Years of United Kingdom National Population Projections: How Accurate have they been?", Population Trends, 128, Office for National Statistics, 2007

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Self-selection by annuitants

UK Annuitant and Pensioner Mortality vs Population

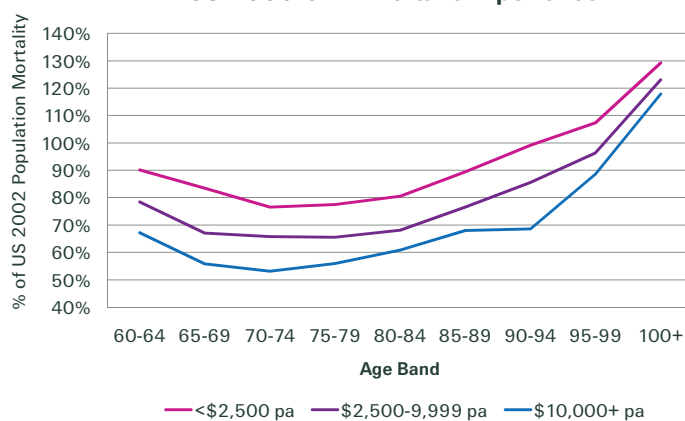


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Healthier people buy more, wealthier = healthier

US 2000-04 Annuitant Experience



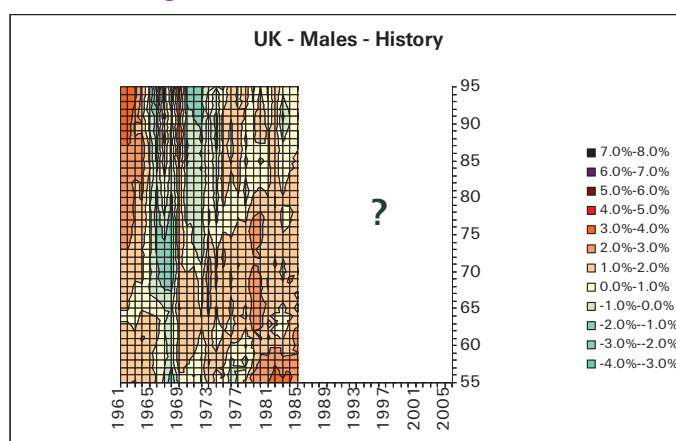
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Actuaries are always conservative... NOT

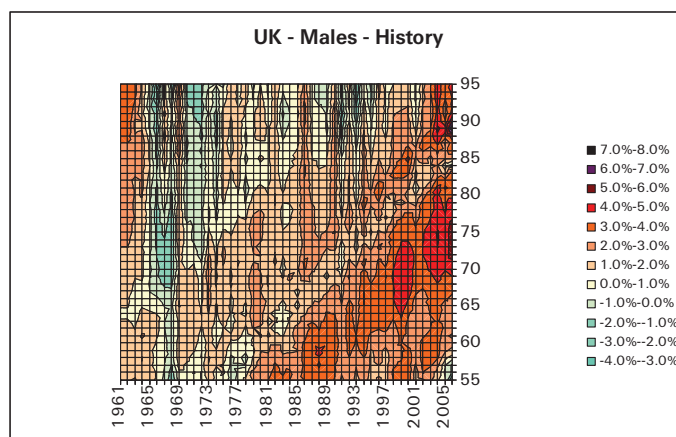
- Actuaries have consistently underestimated improvements in mortality
 - a(90) was based on UK 1967-70 experience projected to 1990, but a(90) mortality was reached in 1980
 - Actuaries use past experience to predict the future – past performance is no guarantee of future results
 - Long time for deviations in mortality improvement trends to be recognised
 - Annuity and pension portfolios experience sudden large changes in liability values when new industry experience studies and tables are released

Forecasting trend risk

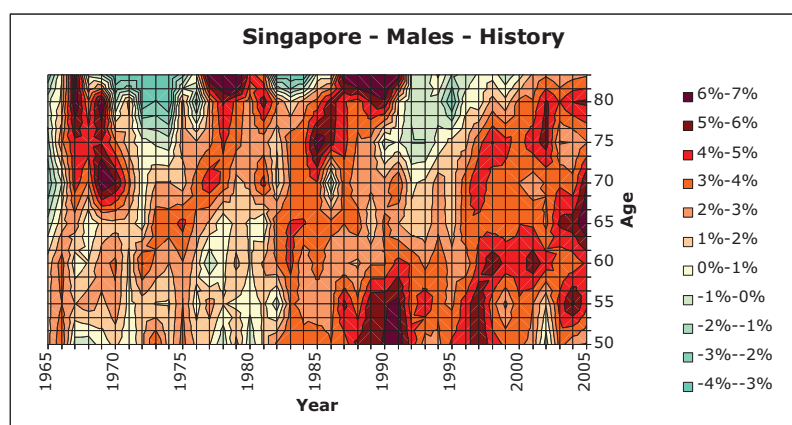


Source: Human Mortality Database (www.mortality.org) with smoothing

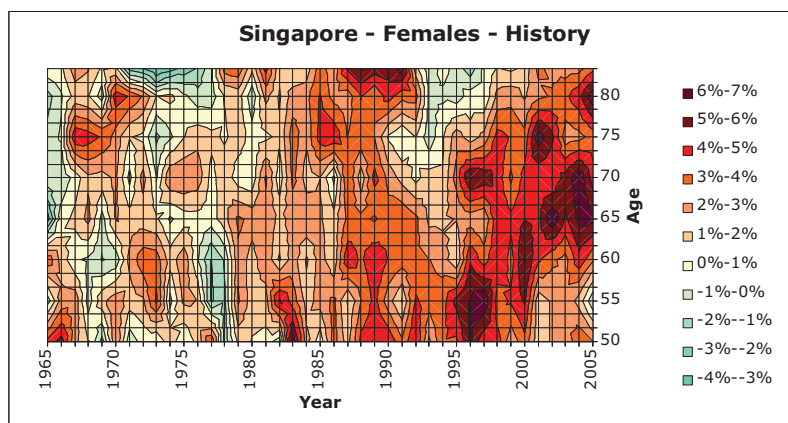
Past performance is no guarantee



It's hard to make predictions, especially about the future



It's hard to make predictions, especially about the future



Source: WHO Mortality Database with smoothing

(Re)Insurer behaviour

- (Re)Insurers think they like annuity business where
 - It is mandatory to take some retirement savings in the form of an income stream
 - There are significant incentives or for annuity purchase
 - tax benefits
 - subsidies
 - No requirement for mark-to-market accounting or reserving
 - No requirement for market consistent pricing / reserving
 - Long-dated investment assets widely available
- Re(Insurers) do not like annuity business
 - Everywhere else

Responding to needs

Market failure

- Insurers don't want to sell <=> Customers don't want to buy
- Roles for forward-thinking governments
 - Compulsory / incentivised savings during working life (to ensure sufficient funds are available for retirement)
 - Government / taxpayer funded comprehensive pension (including intergenerational risk transfer)
 - Government / taxpayer funded safety net pension (including less intergenerational risk transfer)
 - Customer-push via compulsory / incentivised annuitisation combined with Insurer-push via market creation / tender process
 - Risk-based, market-consistent regulation of annuity providers, potentially supplemented by rescue fund for insolvent annuity providers
 - Education and awareness-raising about the risks of old age
 - Support for transfer of longevity risk to capital markets



Insurers in search of a market-clearing price

- Reduce the cost of annuities by taking less risk
 - Pass investment and longevity risk back to individuals (account-based annuities)
 - Pooling risk between individuals, but with limits on systematic risk across the portfolio (tontines)
 - Offer large death benefit / bequest to reduce sensitivity to mortality (return of premium annuities)
 - Reduce self-selection risks and seek economies of scale (compulsory annuitisation)
- Take more risk to justifying increasing the price
 - Provide individuals with investment upside in return for fee income (variable annuities)
 - Provide individuals with liquidity in return for option premium (liquid annuities)



The Singapore solution

- CPF Life
 - Opt-in for those born before 1955, mandatory for those born in 1955+
 - 4 options balancing income and bequest
 - Subsidies for lower income groups via L-bonus
 - Extra 1% interest on first \$60,000 of CPF balances
 - Monthly payouts are adjustable to take into account interest rate changes and mortality experience
 - Low sales of annuities in the private life insurance sector following introduction of CPF Life

The market for longevity risk

Why transfer longevity risk?

- Low interest rates and high rates of benefit indexation increase sensitivity of liabilities to longevity risk
- Mark-to-Market Accounting (eg IFRS) brings volatility from longevity onto company balance sheets
- Insurance companies, pension funds, government authorities have been constantly finding it necessary to increase reserves due to increasing life expectancy
- Uncertainty of pension and annuitant liabilities is endangering credit ratings
- For many organisations, longevity is a non-core or legacy risk an exposure to longevity risk is undesirable



Benefits of transferring longevity risk

- Release solvency capital, increase risk capacity
- Stabilise profitability / minimise the risk of future unanticipated increases in funding requirement
- Protect credit rating
- Focus on managing investments
- Management of non-core legacy business
- Part of a comprehensive de-risking strategy (longevity, inflation and investment risk)
- Scarcity of longevity capacity



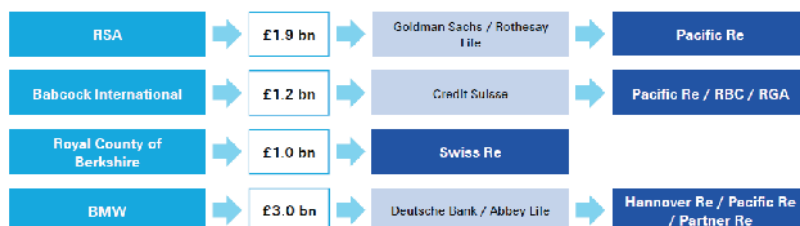
Who wants to take longevity risk?

- Governments already carry lots of longevity risk (shrinking tax base, elderly healthcare, long-term nursing care, etc)
- Corporates are moving away from defined benefit pension funds as costs continue to increase
- Capital markets view longevity as a "novelty" risk
 - demanding additional risk premia
 - prefer short contract durations
 - require full collateralisation
 - preference for index-based / parametric triggers
- Life insurers still active in large annuity markets for a combined package of asset and longevity risk
- Governments, Corporates and Life insurers all managing large in force pension and annuity portfolios



Transferring pure longevity risk

- Of publicly announced longevity swaps completed during the past two years, more than 85% of longevity risk ended up on reinsurer balance sheets



- To date, only two small deals have involved limited transfer of risk to real capital markets investors
- But reinsurer capacity is limited...

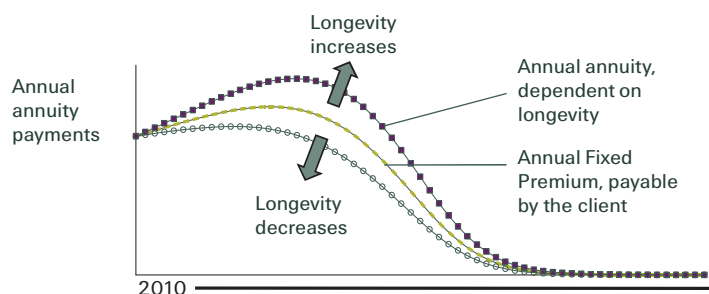
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What is a longevity swap?

- Client pays the same Fixed Premium payments (established at outset of the contract) regardless of changes in longevity
- Swap provider pays the Actual Annuity Payments (Floating) covering the cost if longevity increases, and benefiting if longevity decreases



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Who *really* wants to take longevity risk?

- Those exposed to extreme mortality risk (pandemic, war)
 - Life Insurers and Reinsurers
- Those benefiting from longer life expectancy
 - Healthcare and Pharmaceuticals
 - Nursing homes
- Those looking for diversification against other asset classes
 - Longevity has low correlation with equity and bond values
- Those with a very, very long investment horizon



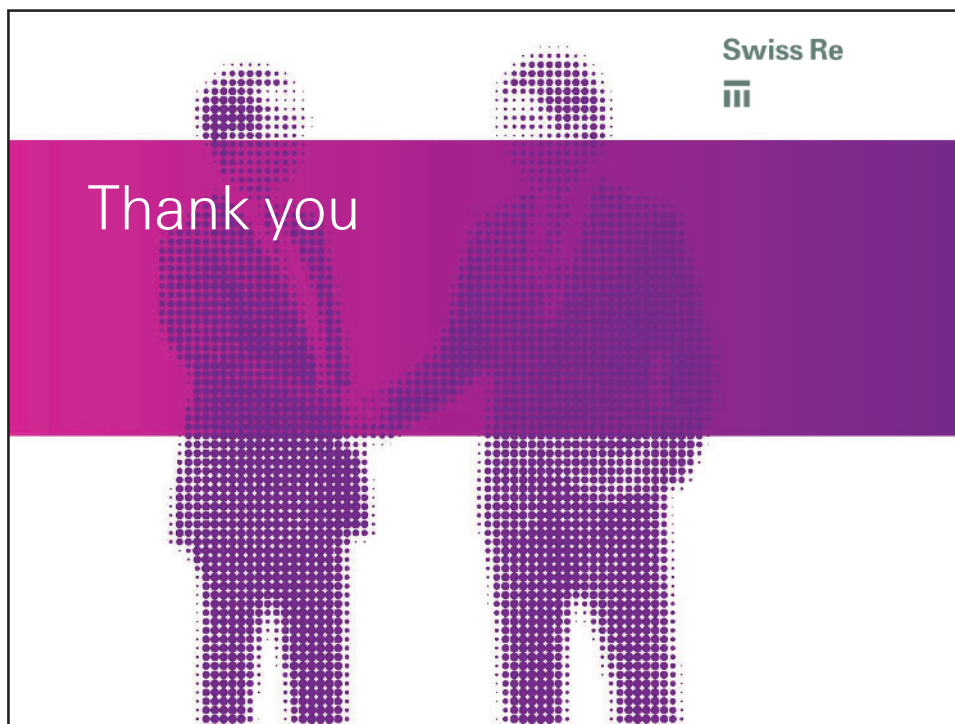
Capital market solutions for longevity

- Active promotion via organisations such as the Life & Longevity Markets Associations (LLMA)
- But a transparent, liquid market in longevity risk will take time to develop
- Likely to focus more on parametric index solutions (ie based on mortality of population index) than indemnity solutions (ie based on mortality experience of specific portfolio)
 - Transfer risks associated with systematic mortality improvement trends
 - Basis risk remains with the direct writer (segmentation, self-selection, statistical fluctuation)
- Ultimately capital markets are likely to be the only hope of finding sufficient capacity to meet demand for longevity risk protection
- Even then, much of the risk may still ultimately be left with individuals or passed back to the general population due to lack of willing buyers

Conclusions

Conclusions

- Increasing dependency ratios and life expectancies mean that the risks of living too long are greater than ever before
- Underestimation of life expectancy, slow realisation of longevity risk and low interest rates have contributed to market failure in providing private solutions for longevity risk protection
- Systematic unpredictability of future mortality improvement trends poses major challenges for providers of longevity risk protection
- Correction of market failure is possible via government intervention, although there are no silver bullets for the creation of sustainable longevity risk protection solutions



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