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## Longevity Derivatives

Illustrating a “New” Approach to Investing

Zac Roberts

- Originally planned to talk about longevity derivatives only
- I talk to a lot of investors and attend a few seminars, and I’m starting to hear some very similar themes
- Many large institutional investors are re-thinking their investment approach
- Thus, I’ve added a section at the front to keep it current, and let me use longevity as an example of big picture investment concepts

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## Contents

- 1. Risk Premia: A “New” Approach to Investing**
2. Longevity as an Asset Class
3. Managing Longevity Risk
4. Discussion


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- Start today with an overview of what has caused this re-think of investment approach
- Then describe a very promising “new” approach to investing that is being discussed
- Move on to longevity, and discuss how you can use this “new” approach to evaluate what would typically be called a highly alternative asset class
- Finally discuss how the types of longevity instruments now available can be used to help institutions that have longevity risk on their liability side
- Hope to have plenty of time for discussion

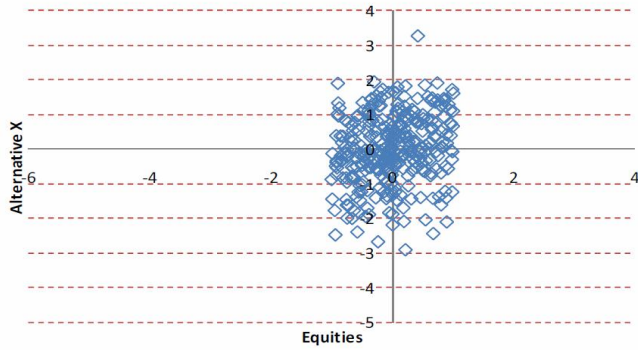
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AP3

**X is a great diversifier for my portfolio**



How correlation behave 1



Within -1 to +1 standard deviations the two assets seem uncorrelated

Source: *International keynote address: The role of Alternatives in asset allocation strategies*, Erik Valtonen, Chief Investment Officer, AP3, Sweden, Terrapinn Asset Allocation Summit, February 2009

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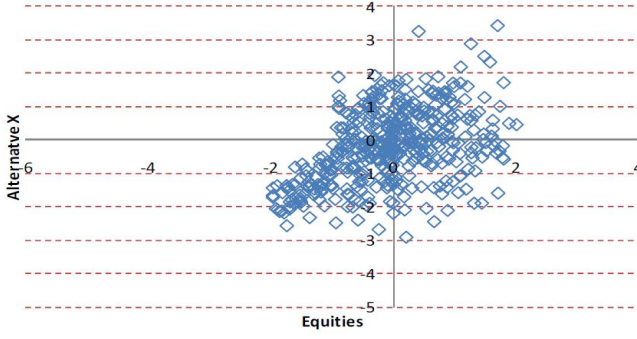
- I've added the man and his comment
- AP3 is the 3rd Swedish National Pension Fund, with about €22 bn under management
- Erik started by explaining how an alternative asset can appear to have very good diversification benefits if its performance is only viewed under normal circumstances

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AP3

### How correlation behave 2

X is a **good** diversifier for my portfolio

Some dependency in the more negative outcomes

Source: *International keynote address: The role of Alternatives in asset allocation strategies*, Erik Valtonen, Chief Investment Officer, AP3, Sweden, Terrapinn Asset Allocation Summit, February 2009

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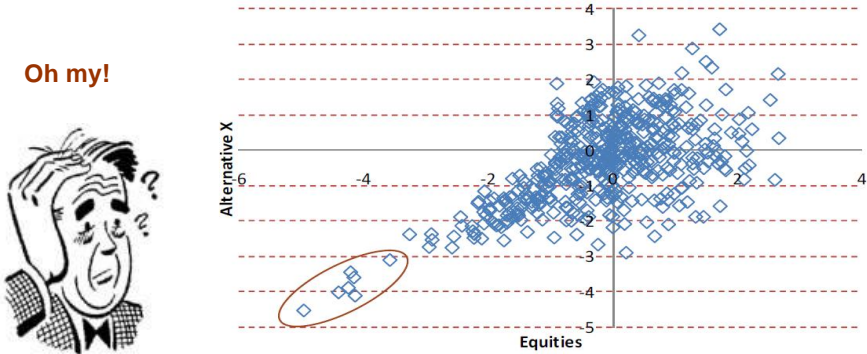
- As things become less normal, it may not look quite so good

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AP3

### How correlation behave 3

Oh my!



Until we find the Murphy's island

Source: *International keynote address: The role of Alternatives in asset allocation strategies*,  
 Erik Valtonen, Chief Investment Officer, AP3, Sweden, Terrapinn Asset Allocation Summit, February 2009

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- In the extremes, investors get a rude shock
- I think Murphy's Island is a land where Murphy's Law rules

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AP3

### How correlation behave 4

**It's all gone pear-shaped**

Source: *International keynote address: The role of Alternatives in asset allocation strategies*,  
 Erik Valtonen, Chief Investment Officer, AP3, Sweden, Terrapinn Asset Allocation Summit, February 2009

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- Nobody likes the pointy end of a pear

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Traditional “Alternative” Assets

Private Equity  
Infrastructure  
Hedge Funds

Why have my  
alternative assets  
not performed as  
expected?



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- Many investors have been left holding expensive alternative assets that quite frankly haven't behaved alternatively
- Recurring theme of the Terrapinn Asset Allocation Summit was investors' disappointment in the performance of their alternative assets

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**Traditional “Alternative” Assets**

Aha!  
 My alternative assets have performed exactly as expected.

Private Equity  
 Infrastructure  
 Hedge Funds

Equity Risk Premium  
 Debt Risk Premium  
 Liquidity Risk Premium  
 Property Risk Premium  
 Funding Risk Premium  
 Interest Rate Term Risk Premium

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- If you examine closely, you find that what was being called “alternative assets”, was quite often a mix of traditional risk premia with:
  - Leverage;
  - Illiquidity; and
  - High fees
- Once you do this analysis, you realise that these “alternative assets” have behaved exactly as expected



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## Understanding Risk Premia is Key

- “A risk premium is payment received over and above the risk-free rate as compensation for putting capital at risk
- Asset classes are aggregates of several risk premia and recent market turbulence has highlighted that the mainstream asset classes of equities, credit and property are all fundamentally linked to the same risk factor – corporate earnings
- When the investment universe is viewed as a selection of premia, it forces investors to recognise that risk has little to do with when times are ‘normal’ but everything to do with when something unusual and out of the ordinary occurs
- Over the next 10 years there will be an increased focus on risk premia and finding more cost-effective ways of accessing both traditional and alternative premia”

Source: *Back to the basics – risk premia and alternative beta*,  
Simon O’Grady, Global Premia, Tyndall Investment Management, January 2009

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- So, what is the answer?
- Starting to hear people talk about focusing on understanding your assets – what drives their returns and what are the major risks
- A good example of this is a brief article about risk premia published by Simon O’Grady
- 1<sup>st</sup> point - If there were no risk premia, then investors would have no incentive to take risk and would leave all their capital in cash
- 2<sup>nd</sup> point - Focus should be on understanding the drivers of returns for your assets, and the risk factors
- 3<sup>rd</sup> point - It is no use claiming an asset mix is diversified if the risk factors underlying the assets are the same, just because the returns have exhibited low correlation during times when these risk factors have not been stressed

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## Benefits of Risk Premia Focus

- “When an investor focuses on risk premia as the portfolio building blocks it can deliver a number of benefits:
  1. Makes investors highly risk aware and prompts them to first ask the question: “where is the risk coming from?”
  2. Makes investors explicitly examine the premium they are paid for each particular risk and whether that premium is high enough.
  3. Highlights the fact that risks are like insurance premia and are ‘fat tailed’.
  4. Provides a framework in which to evaluate the performance of all investments and identify other valuable non-traditional risk premia.”
- Main role for a fund manager should be to understand the risk premia available and adjust the fund’s exposure to each risk premia over time

Source: *Back to the basics – risk premia and alternative beta*,  
Simon O’Grady, Global Premia, Tyndall Investment Management, January 2009

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- A common theme at the Terrapinn Asset Allocation Summit in February was that Super funds are starting to down-play the hunt for alpha, and will start to focus more on ensuring that they have the right mix of risk premia, both for their risk/return preferences and for the economic environment
- I strongly believe that adjusting the mix of risk premia frequently over time is the best role for a fund manager
  - Example of doing this in a few pages
  - Also come back to this point at the conclusion of this section

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## Demystifying the Market Timing Objection: 1

*"I thought that Sticking to a Long-Term Strategic Asset Allocation was the only way to invest"*




- So, are you saying that I should hold basically the same proportion of my assets in fixed income regardless of whether interest rates are 2% or 12%?
- Also, are you saying that I should hold basically the same proportion of my assets in equities regardless of whether they are trading at a P/E ratio of 25 or 10?
- If equity P/E ratios mean-revert and the long-term equity risk premium is constant, surely the medium term expectation must be different at such vastly different P/E ratios
- What about considering credit as an alternative way of accessing the equity risk premium?

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- Phrased in this way, I find it difficult to accept that the best investment approach is to:
  - Determine a Strategic Asset Allocation
  - Review it every few years
  - Allocate the rest of your resources to attempting to maximise returns within each asset class
- Wouldn't it be better to allocate most of your resources on selecting the risk premia themselves (and/or choosing from the options of how you access them)
- Example: Credit spreads at all time wides, with implied probability of default much worse than that implied by equity markets, which are at long-term average P/E ratios
  - Switching from equities to credit at the moment can be viewed as an example of selecting the best way to gain access to the equity risk premium, not as switching between asset classes
  - Example of maximising risk-adjusted returns

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## Demystifying the Market Timing Objection: 2



*“Maybe you’re right, but surely it is too difficult to consistently add value over the long-term through market timing”*

- **Active Equity Management:** Adjusting your allocation between different equities based on an assessment of the relative value of the equities available
- **Active Risk Premia Management:** Adjusting your allocation between different risk premia based on an assessment of the relative value of the risk premia available
- **The Same Thing:** But there is much more scope to add value with active risk premia management as the differences between risk/return of the risk premia are greater



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- Maybe actively allocating to different risk premia is too difficult
- However, as discussed, most people who use the market timing objection as justification for sticking to a strategic asset allocation, then allocate most of their resources to trying to maximise returns within each asset class, through active management
- Go through slide
- Can anyone point out what I am missing, because this seems very hypocritical to me
- Note that active risk premia management doesn't necessarily mean frequently changing your core assets – Vinay Pande example on next page

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## A “New” Approach to Investing

1. Understand your liabilities or investment objective and your risk appetite
2. Understand the range of risk premia available
3. Determine your desired mix of these risk premia, looking at both the asset and the liability side of your balance sheet
4. Determine the best way of gaining access to each risk premia
5. Investigate whether any form of down-side protection can be incorporated economically, considering both your asset and your liability risks
6. Review and adjust your mix of risk premia frequently



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- Go through points on slide
- For point 5, give Vinay Pande as example:
  - Former CIO of World Bank
  - Now Head of Investment Advisory Group at Deutsche Bank
  - Runs a theoretical research fund
  - 2.5 yr return till end of Dec 08 of 35% pa
  - 23% return in 4<sup>th</sup> quarter 08 alone
  - Core assets are long-term growth, EM focus
  - Overlays with direct hedges or defensive assets that protect against main risks to the portfolio
  - For example, in 4Q 08, gains were largely due to a long equity volatility position he took to protect against equity market fall
  - Publishes “fund” info every quarter, with details behind investment approach and reasoning behind investments

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## Benefits of the “New” Approach



**Maybe we can  
avoid the trillion \$  
superannuation  
mis-selling  
scandal**

1. Asset class allocation decisions would be made by those most capable of making them
  - a. Presently, investment managers focus on delivering performance within an asset class
  - b. The selection of asset classes is left to individuals, sometimes with help from a financial planner
  - c. Where can the most value be added?
  - d. Who is most qualified to make this decision?
2. Huge opportunity for the funds management industry to deliver what they believe investors want
  - a. Many balanced funds say they target “inflation + x% over the medium term” but do nothing of the sort

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- Unfortunately, the investment management industry focuses on maximising returns within an asset class
  - The difficult job of putting the asset classes together is often left to individuals, with help from their financial adviser
  - I think this is wrong – I have nothing against financial advisers, but people who spend their whole working hours dealing with markets and investments are surely better placed to make this most important asset allocation decision
- Trillion \$ superannuation mis-selling scandal
  - Most balanced funds claim to target inflation + 3-4% over medium term
  - Past 12 months inflation – 20%
  - What will they do differently over next 4 years to try to earn their target over the 5 years that started 1 year ago? Nothing possible.
  - What will they change to ensure this problem doesn't happen again?
  - If nothing, how can they look themselves in the mirror and say they target inflation + something? If they thought their current asset mix would earn inflation + 3% over 5 years 1 year ago, do they now think it will earn inflation + 10% over the next 4 years?
  - They may hope for inflation + 3-4%, but they don't target it.
  - If target is inflation + 3%, buy an inflation swap at 2.5%, which leaves you with the target of earning 5.5%: BankWest, sell gov't CDS?

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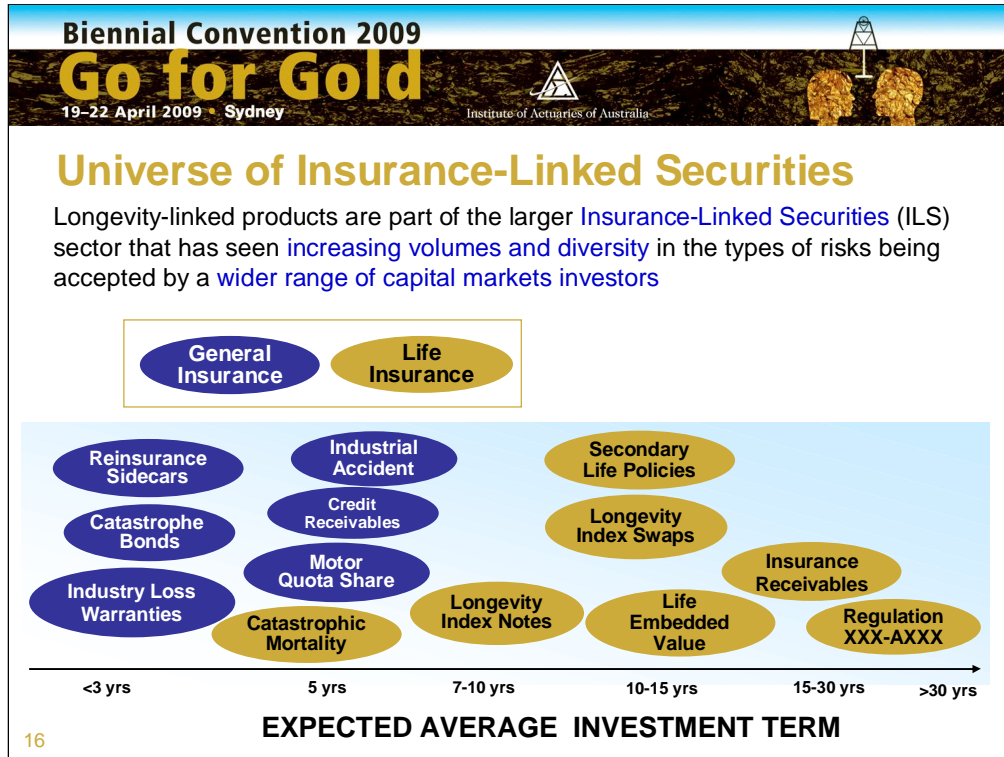
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- Now that we’ve covered all that, lets take a deep breath, put our differences aside, and turn our attention to longevity
- I am seeing much more interest in Insurance-Linked Securities, such as longevity, due to the fact that the return drivers are uncorrelated to other assets
- Importantly, uncorrelated not because they are illiquid and valued infrequently, but because they are driven by different factors than those that drive other asset classes
- I’ll explore longevity in the framework described:
  - Understand the driver of returns
  - Understand the risks
  - Determine the best way of gaining access to the longevity risk premium



- Longevity forms part of a wider group of Insurance Linked Securities (ILS)
- These are generally split between general insurance and life insurance.
- ILS have become increasingly attractive due to the fact that their performance in general has been steady for the past year.
- Further, the recent increase in the cost of capital for reinsurers means that they are now prepared to pay away more for these investments.
- Common feature of ILS is that the underlying risk premium is driven by economic asymmetry and/or information asymmetry which benefits the investor. This is what gives rise to the fact that this is not a zero sum game but rather a positive risk premium



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### Drivers of Returns for Longevity-Linked Transactions

Low ← **EXPECTED RETURN** → High

**Catastrophic Mortality**

Capital savings achieved by the reinsurer that issues the bond

**Securitisation, e.g. Embedded Value**

Funding provided to the insurer from the fact that these instruments monetise an insurer's intangible assets

**Life Insurance Policy Based Investments**

Economic and information asymmetry created by low surrender values offered by life insurers on life insurance policies

A life office would typically offer the insured around **4 per cent** of face value if they chose to surrender the policy, whereas buyers in the second hand market are willing to pay around **30 per cent**

17 Source: "Till death do us part", Andrew Walters, Financial Adviser, 22/1/09

- Different formats of ILS have different return drivers.
- For example, the asymmetry in ILS may be there because it could be cheaper for a reinsurance company to pay coupons that will exceed expected losses for a cat bond or extreme mortality bond rather than holding expensive capital against potential losses.
- The asymmetry for Life Insurance Policy based investments is related to so called surrender values that for various reasons are too low. As the quote says, life insurers may pay 4% of face value for a policy which the market will trade at 30%. Even at 30% of face, these policies may be priced to yield an expected return of 15% pa. To see what all this means, we need to understand a bit more about how the secondary market for life policies works.
- Financial Adviser is a weekly publication for European financial advisers. Covers pension management, life insurance companies, savings and loans, and related market statistics.

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### Longevity Risk Premium for Policy Based Investments

```

    graph TD
      IC[Insurance Company] -- "Large life policy" --> PH1[Policy Holder]
      PH1 -.- "Over time..." -.-> PH2[Policy Holder]
      PH2 -- "On-sell policy to investor" --> I[Investor]
      PH1 -.- "Surrender policy to insurer" -.-> IC
      style PH1 stroke-dasharray: 5 5
      style PH2 stroke-dasharray: 5 5
      style I fill:#008000,color:#fff
      style IC fill:#000080,color:#fff
      style PH1 fill:#800000,color:#fff
      style PH2 fill:#800000,color:#fff
    
```

- Investor becomes the owner and beneficiary of the life insurance policy
  - Investor pays an upfront amount to purchase a policy
  - Investor pays regular premiums on the policy
  - Investor receives policy proceeds upon death of the insured
- IRR impacted by
  - Size of initial purchase price
  - Size of ongoing premiums
  - Timing and size of death benefit

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- An older age US citizen who would like to monetise the value in their life policy (no longer needs protection, or may need the cash)
- He could sell it back or surrender it to the insurance company, who will pay him a fraction of its true value (low surrender value).
- The policy holder can instead sell his policy to an investor who becomes the new beneficiary of it and will receive the death benefit when the person passes away, so long as the investor keeps paying the policy premiums.
- Unlike the insurance company, the investor has access to recent medical reports and a life expectancy report, and can pay whatever he wants for the policy, ie he can differentiate in his pricing
- That means that he will be able to pay much more than the Ins Co. but still significantly below “fair value” for the policy. An average policy may sell at an estimated IRR of 14-15% in USD terms.
- The policy holder is still happy because he gets a lot more for his policy in dollar terms than if he sold it back to the Ins Co.
- Hence, an economic and information asymmetry favouring the investor, at the expense of the Ins Co.

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## Longevity Investments: Truly Uncorrelated

the return is known and is **not dependent on the investment strategy** of the life office\*

**“When performing actuarial analysis, it is conventionally assumed that there is zero correlation between mortality rates and the capital markets. This is generally supported by historic data since mortality rates have steadily and fairly smoothly decreased, whilst equity markets have behaved erratically in the short term and grown exponentially in the long-term and interest rates have tended to revert to the mean. There seems little prospect of identifying a meaningful connection between mortality [...] and financial risk drivers.”** Source: Deloitte, May 2005

19 \* Source: “Till death do us part”, Andrew Walters, Financial Adviser, 22/1/09

- As we just saw, the return of a policy investment will depend on things like the size of the purchase price, the ongoing premiums and the timing and size of the death benefit.
- In particular, the investor buying the policy knows the amount he'll receive when the policy holder passes away, but doesn't know when he'll receive it. That's why the actual longevity, as compared to the expected longevity, will matter for the IRR of a longevity investment. This is not driven by the same factors that drive conventional risk premia.
- So unlike many other alternatives, this is an example of an alternative that is actually worthy of its name, and will add to the diversification of a portfolio.
- Longevity of large populations has low volatility, but buying a single policy could be a very volatility investment
- Thus, it is very important to examine the best way of gaining access to the longevity risk premium

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## Longevity Index Swap: Overview

**Cash Flow Timeline for Longevity Index Swap**

**Payments to Investor**  
 Reference Notional Amounts payable on the death of a reference individual

**Payments from Investor**  
 Scheduled Payment Amounts payable as long as the reference individual is still alive

**Cash flows are linked to the mortality performance of a pool of equally weighted lives**

- Initial**
  - Investor pays amount equivalent to purchasing policies on the lives
- Ongoing**
  - Investor pays amount equivalent to a premium for all lives still alive
  - Investor receives amount equivalent to a death benefit for lives that passed away during the quarter

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- Basically mirrors the economics of purchasing equal-sized policies over a large number of lives
- Go through cash flows as per slide
  - Up-front amount = purchase price for policies
  - Throughout swap, investor pays premiums for individuals still alive
  - Investor receives death benefit when an individual passes away

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## Longevity Index Swap: Advantages

- Preserves the economics of purchasing policies
- Removes non-longevity related risks and costs
- Improves investment efficiency

Reduced volatility of return through equal exposure to a large number of lives

Retain Longevity Risk Premium...      ...without the additional risks and costs

<ul style="list-style-type: none"> <li>Uncorrelated Asset</li> <li>High Expected Returns</li> <li>Low Volatility</li> </ul>	<ul style="list-style-type: none"> <li>Documentation Risk</li> <li>Regulatory Concerns</li> <li>Ramp-Up Delays and Risks</li> <li>Insufficient Number of Lives</li> </ul>	<ul style="list-style-type: none"> <li>Legal Risk</li> <li>Administrative Burden</li> <li>Uncertain Maturity</li> <li>High Brokering Fees</li> </ul>	<ul style="list-style-type: none"> <li>Portfolio Lumpiness</li> <li>Tax Risk</li> <li>Insurable Interest</li> <li>Carrier Credit Risk</li> </ul>
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- Note that I am not a fan of structuring, unless it adds value
- Benefit here is reduced volatility of return through equal exposure to a large number of lives for a small investment
- Thus, an index product lets the investor
  - retain the economics of the longevity risk premium (uncorrelated, low volatility, high return potential)
  - while removing the non-longevity related risks associated with directly purchasing policies
  - and improving the investment efficiency
- **Why is it important to have a large number of lives?**
- Many lives causes the return to be less volatility and settle around the market risk premium, or the longevity beta, of approx. 15%
- **Why an index as opposed to buying lots of policies?**
- Equal size exposure across lives avoids volatility due to large sums assured
- Much smaller investment size is possible
- Admin benefits – hard to buy lots of equal sized policies
- Legal issues, requiring extensive due diligence
- **What are the major disadvantages**
  - Less liquid
  - More complex

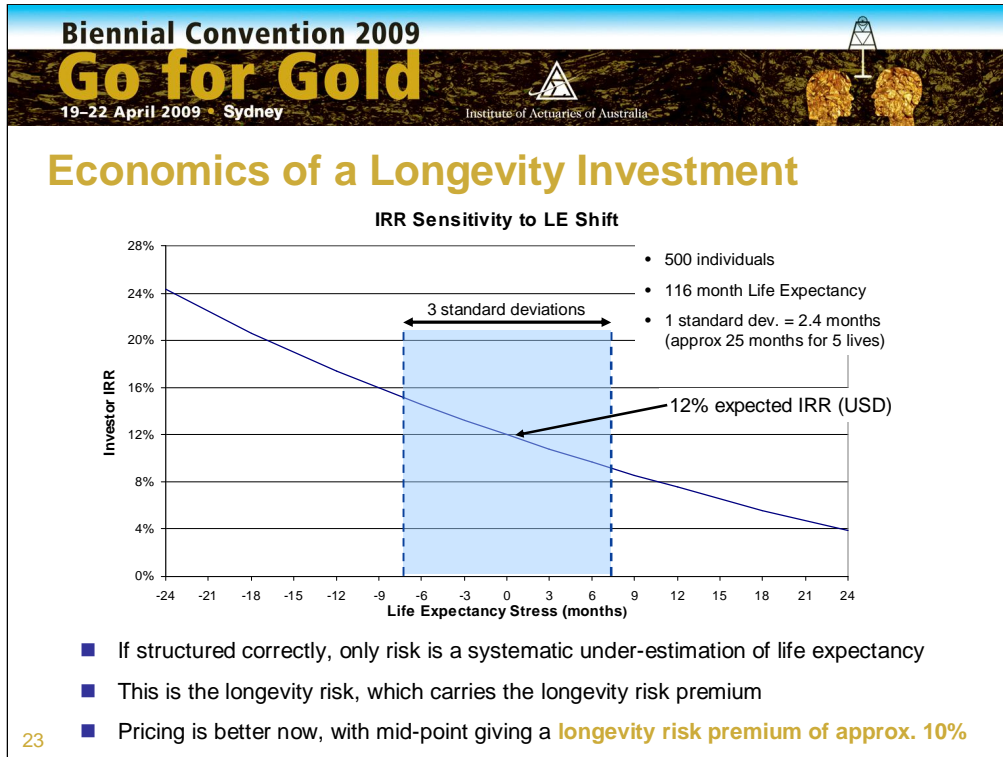
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## Investing in a Longevity Fund

	Advantages	Disadvantages
<b>Conventional Longevity Fund</b>	<ul style="list-style-type: none"> <li>Investors are familiar with owning units</li> <li>Removes purchasing and admin effort</li> <li>Can gain exposure to a large number of lives for a small investment</li> </ul>	<ul style="list-style-type: none"> <li>High Fees, e.g. 2% pa + performance fee</li> <li>Fund manager risk, e.g. premium financing</li> <li>Usual problems of illiquid assets in a liquid fund, e.g. run on fund, forced asset fire-sale</li> </ul>
<b>Bespoke Longevity Fund</b>	<ul style="list-style-type: none"> <li>Investors are familiar with owning units</li> <li>Removes purchasing and admin effort</li> <li>Receive more of the asset class return</li> <li>Investor is in control, and is not exposed to the behaviour of other investors</li> </ul>	<ul style="list-style-type: none"> <li>Significant investment required to gain exposure to enough lives to limit volatility</li> <li>No manager acting in the investor's interests, but an actuarial consultancy can address this by assisting in policy pricing and purchase</li> </ul>

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- Investors wanting to limit complexity but still gain the benefits of a longevity index swap could look at investing in a longevity fund
- While investing in an existing longevity fund achieves this goal, I think this approach has several key disadvantages
- If you are an institutional investor with enough to invest, you can basically create your own fund
  - Achieve most of the benefits of an index swap
  - With greater liquidity and less complexity
  - Without the disadvantages of investing in an existing fund



- Graph shows benefits of low volatility created by a large number of lives
- The impact of random differences in the time of death compared to the expectation is small, e.g. in this example returns are within 9% to 15% with 3 standard deviation confidence, higher in AUD
- This is old (mid 08), and pricing is currently a little better
- But, risk remains that the expected time of death is incorrect
- We cannot, nor do we want to, remove this risk
- This is the longevity risk premium we are trying to access
- Importantly, the arbitrage inherent in the secondary policy market means that this risk increases or decreases returns around an expected return of approx. BBSW + 10%, not BBSW
- Not fluctuating either side of risk-free rate, i.e. 10% risk premium

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**Longevity Investments: Unique Source of Diversification**  
 High Expected Return, Low Volatility and Low Correlation


	Non-correlated asset	High return potential	Low volatility	Liquidity
Longevity	✓	✓	✓	Limited
Equities	✗	✓	✗	✓
Government Bonds	✗	✗	✓	✓
Credit	✗	✓	✗	✓ ?
Commodities	✓	✓	✗	✓
Emerging Markets	✗	✓	✗	Limited
Hedge Funds	✗	✓	✗	Limited
Real Estate	Limited	✓	✗	Limited

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- Back to basics for a minute
  - Alternative assets still offer large benefits
  - More scrutiny re what is classified as an alternative asset and in understanding what drives the returns
  - Diversification needs to be genuine – returns driven by different factors
- ILS are a good example of something that is truly alternative
  - Clear driver of return means truly uncorrelated
  - Longevity as driver means low volatility – yes it is illiquid, but that isn't what drives low volatility / correlation
  - Asymmetry means high return potential
  - Attractive, but should access in best format
- This description of longevity is a good summary of how the principles outlined in the first section should be used when evaluating any asset class or risk premium



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- Now look briefly at how institutions with longevity risk on the liability side can use the growing longevity market to help manage their longevity risk

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## Hedging Longevity Risk: Case Study

```

    graph LR
      LI[Life Insurer] -- "Up-front Single Premium and /or Ongoing Premiums" --> SC[Swap Counterparty]
      SC -- "Annuity Benefits" --> LI
  
```

- Life Insurer enters into a longevity swap
  - Life Insurer receives actual life contingent annuity benefits
  - Life Insurer pays an up-front reinsurance premium and/or ongoing premiums
- Collateral arrangements manage counterparty credit risk
- Key benefit over traditional reinsurance is that the life insurer retains their assets
- Though started by banks, reinsurers can probably offer this at a better price

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- Key benefit is that it lets you keep your assets
- Don't have to sell them at distressed prices
- Even if they aren't distressed, don't have to sell an amount of credit bonds calculated using a risk-free discount rate even though you expect the bonds to earn more than the risk-free rate – if you didn't why are you holding them
- Reinsurers have better pricing data and more importantly offsetting risks, so that entering a longevity swap may actually reduce their net mortality risk exposure
- This leads to significant capital advantages compared to a bank

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## Improving Return on Longevity Risk: Case Study

**Australian institution with longevity risk (Life Insurer, DB Super, Government)**

- Willing to retain some longevity risk if it provides a good expected return on capital/risk
- Wants to reduce capital required and/or increase the expected return on capital

**Execute a longevity swap to remove Australian longevity risk**

**Execute a longevity swap to introduce policy based longevity risk**

<ul style="list-style-type: none"> <li>• Set swap size such that total capital required does not change</li> <li>• Expected return on capital will increase due to economic arbitrage inherent in policy based longevity instruments</li> </ul>	<ul style="list-style-type: none"> <li>• Set swap size such that total expected return does not change</li> <li>• Capital will decrease as the policy based longevity risk will require less risk to deliver the same expected return</li> </ul>
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- Consider longevity like any other risk
  - How much of it do you want at its current expected return on capital?
  - How much of it do you want at a much better expected return on capital?
  - How does this much better expected return on capital compare to the expected return on capital from other risks you are taking
- Personally, I think this is an extremely attractive approach, that all institutions with longevity risk on the liability side should explore
- Think of how much it could help the Australian government's looming pension crisis



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