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The Geneva Association - General Secretariat - 53, route de Malagnou - CH-1208 Geneva
Tel.: +41-22-707 66 00 - Fax: +41-22-736 75 36 - secretariat@genevaassociation.org - www.genevaassociation.org

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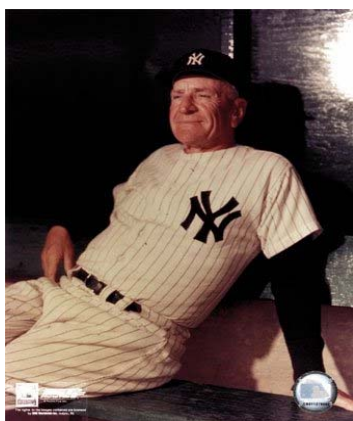
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Layout & Distribution: Valéria Kozakova

Annuity Risk Products and ILS Market Development

Ed Giera

Our perspectives on longevity risk continue to evolve...

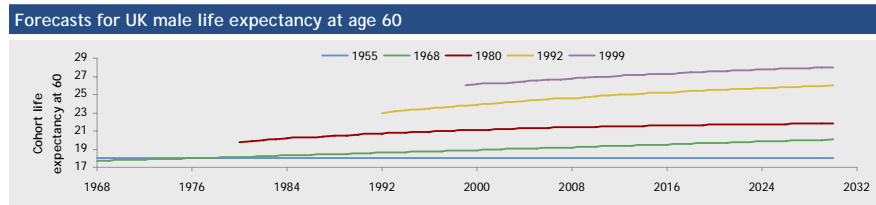


After the 1960 season, NY Yankee officials announced they were letting legendary manager Casey Stengel go.

Club executive Dan Topping explained later: "I'm just sorry Casey isn't fifty years old It's best for the future to make a change." Casey said: "I'll never make the mistake of being seventy again."

On the occasion of his 75th birthday in 1965, as then manager of the NY Mets, Casey remarked: "Most people my age are dead at the present time, and you can look it up!"

... as forecasts repeatedly have under-estimated life expectancy



Source: CIMC Actuarial profession, Mervyn King "What fates impose: Facing up to uncertainty", The Eighth British Academy Annual Lecture 2004

Life span probability

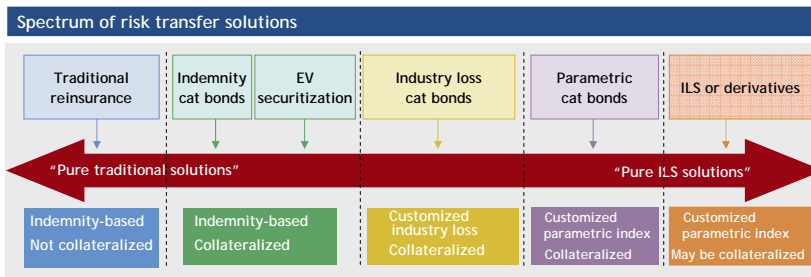
Current age	% chance reaching 85	% chance reaching 90	% chance reaching 95	% chance reaching 100
35	69	50	30	14
40	67	49	28	12
45	66	47	26	11
50	64	45	24	10
55	64	44	23	9
60	63	43	22	8
65	63	42	21	7

Source: Watson Wyatt Limited on the basis of PMA and PFA Mortality tables

- Prospects for reaching advanced age are increasing
- Longevity in many developed countries is increasing by 2% per year
- Life expectancy for a UK 60-year old male today is 86. On present trend in 2021 it will be 88, potentially higher

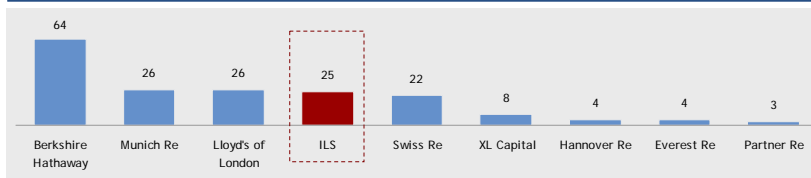


ILS are positioned between reinsurance and capital markets, and provides substantial capacity



Source: The Insurance Insider executive briefing: "Trading risk" (Autumn 2007), Swiss Re

ILS as a material source of reinsurance capacity (book equity of main reinsurers and ILS outstanding in \$bn at year-end 2006)

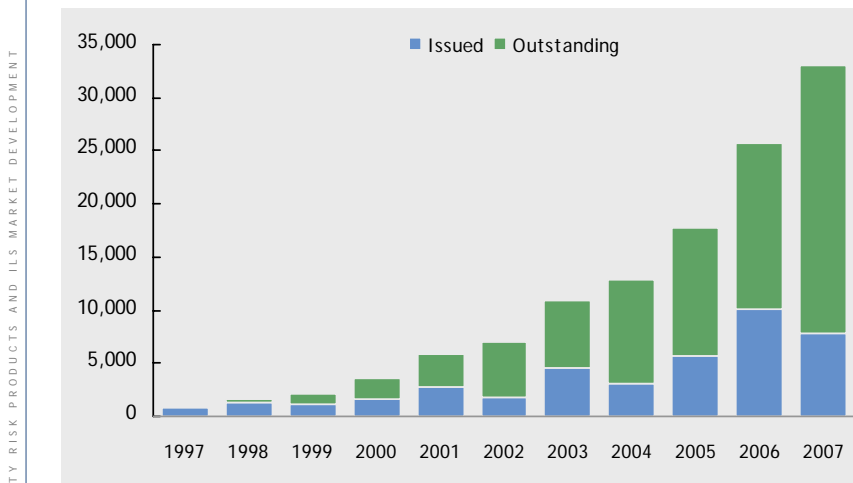


Source: Swiss Re



Growth in ILS issuance and volumes outstanding

Total ILS outstanding—by year (in \$mm)

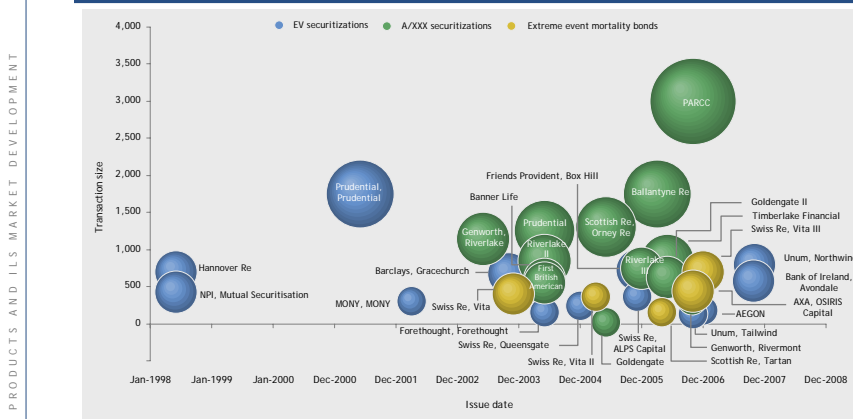


As of July 2007
Source: Swiss Re Capital markets



Life ILS market transactions

Life securitizations by size (in US\$ mm) and issue date



What the academics are saying

"... there seems to be broad agreement that there exists a market price for systematic mortality risk. However, there seems to be no agreement on the structure and level of this price, and how it should be incorporated when valuing insurance products or mortality derivatives."
Pricing Longevity Bonds using Implied Survival Probabilities, Bauer and Russ, 2006

$$F_{\lambda}^* = \Phi(\Phi^{-1}(F(x)) - \lambda)$$

"Securitization of longevity risk is not only a good method for risk diversifying, but also provides low beta investment assets to the capital market".

The Design of Securitization for Longevity Risk: Pricing Under Stochastic Mortality Model with Tranche Technique, Liao, Yang, and Huang, 2007

"... the absence of an instrument to help hedge against longevity risk is a key reason for underdeveloped annuity markets."
Financial Innovation for an Aging World, Mitchell, Piggott, Sherris and Yow, 2006

$$F(x) = p \sum_x (m_x - s_x)^2 + (1-p) \int \left(\frac{d^2 s_x}{dx^2} \right)^2$$

"At plausible coefficients of risk aversion, investors should be able to hedge aggregate mortality risk via [mortality] bonds at very low cost".
Life is Cheap: Using Mortality Bonds to Hedge Aggregate Mortality Risk, Freidberg and Webb, 2005

ANNUITY RISK PRODUCTS AND ILS MARKET DEVELOPMENT



What has changed and why are derivatives gaining momentum?

- Investor interest has been piqued
 - ILS hedge funds are seeking to diversify their exposure away from pure nat-cat through life insurance risks
 - Mainstream investors are seeking to expand their multi-format risk analysis platforms to cover new exposures
- Insurer motivation has increased
 - Persistent low interest rates have increased the impact of longevity
 - Solvency II will introduce an explicit capital charge for longevity
 - In the UK, longevity risk has carried an explicit capital charge since 2004
- Investor and insurer incentives have combined to reduce the bid-offer gap between buyers and sellers
- Advances in risk management techniques now allow unfunded solutions for which investment banks are able to act as intermediaries

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What the market is doing

Investment banks and reported activities

JPMorgan

- Launched LifeMetrics, an platform of international indices and toolkit for measuring and managing longevity and mortality risk
- Established longevity risk trading desk for life settlements and LFMT based derivatives
- Founding investor in Synesis Life

UBS

- Founding member of Institutional Life Markets Association

Deutsche Bank

- Founding investor in Paternoster
- Acquired ALBA Life from Scottish Widows in 2007
- Active life settlements trading business

CREDIT SUISSE

- Launched Credit Suisse Longevity Index for US population in 2006
- Active life settlements and trading business
- Dedicated longevity trading business for ILS and derivatives

Swiss Re


- Active in extreme mortality risk securitization through Vita platform since 2003

Goldman Sachs

- Formed Rothsays Life to write bulk annuities in September 2006
- Building life settlements trading business

BEAR STEARNS

- Developing electronic trading platform for life settlements and mortality bonds






Death Bonds

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Key characteristics of LifeMetrics

- **Key advisors - LifeMetrics has been developed with:**
 - Watson Wyatt (UK and US)
 - Pensions Institute at Cass Business School
- **International indices**
 - US, England & Wales, and Netherlands based on national population data
 - Other countries will be added in the coming months (eg. Germany)
- **Standardized building-block hedges**
 - Building-block approach to hedges based on standardized format
 - Balance the need for effective hedges with the need for liquidity
- **Transparent framework**
 - Methodology, algorithms and calculations are fully disclosed
- **Governance**
 - Advisory Committee to safeguard integrity of the LifeMetrics Index
 - Independent Calculation Agent

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q-Forwards are standardized derivatives for transferring longevity and mortality risk

- q-Forwards (mortality forwards)
 - Exchange the realized mortality rate in a future period for a pre-agreed fixed mortality rate
 - There is no upfront payment, only a payment at maturity
 - A contract settles at the difference between the fixed forward rate and the realized rate

q-Forward structure

Cashflows on Maturity Date:

Pension Plan

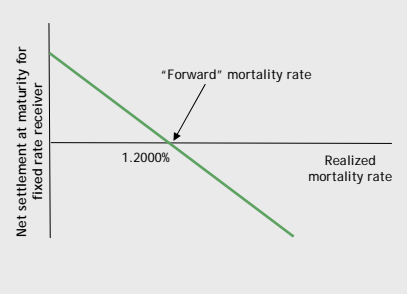
↔


Hedge Provider

Fixed: Notional x Fixed rate x 100


Realized: Notional x LifeMetrics Index mortality rate (Realized rate) x 100

q-Forward payoff diagram



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A portfolio of standardized building-block derivatives can hedge the mortality sensitivity of an annuity liability

Annuity liability portfolio

Underlying population

Males	Females
50 yr	50 yr
:	:
60 yr	60 yr
:	:
70 yr	70 yr
:	:
80 yr	80 yr
:	:
90 yr	90 yr
:	:
100 yr	100 yr
:	:

Sensitivity blocks

Bucketed sensitivity of portfolio value to changes in mortality rates

Portfolio Value		Ages 60–69 Males	Ages 60–69 Females
		Ages 70–79 Males	Ages 70–79 Females
		Ages 80–89 Males	Ages 80–89 Females

Hedge building blocks

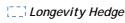
Building block hedges of mortality rates using LifeMetrics Index


Ages 60–69 Males	Ages 60–69 Females
Ages 70–79 Males	Ages 70–79 Females
Ages 80–89 Males	Ages 80–89 Females

LifeMetrics Index

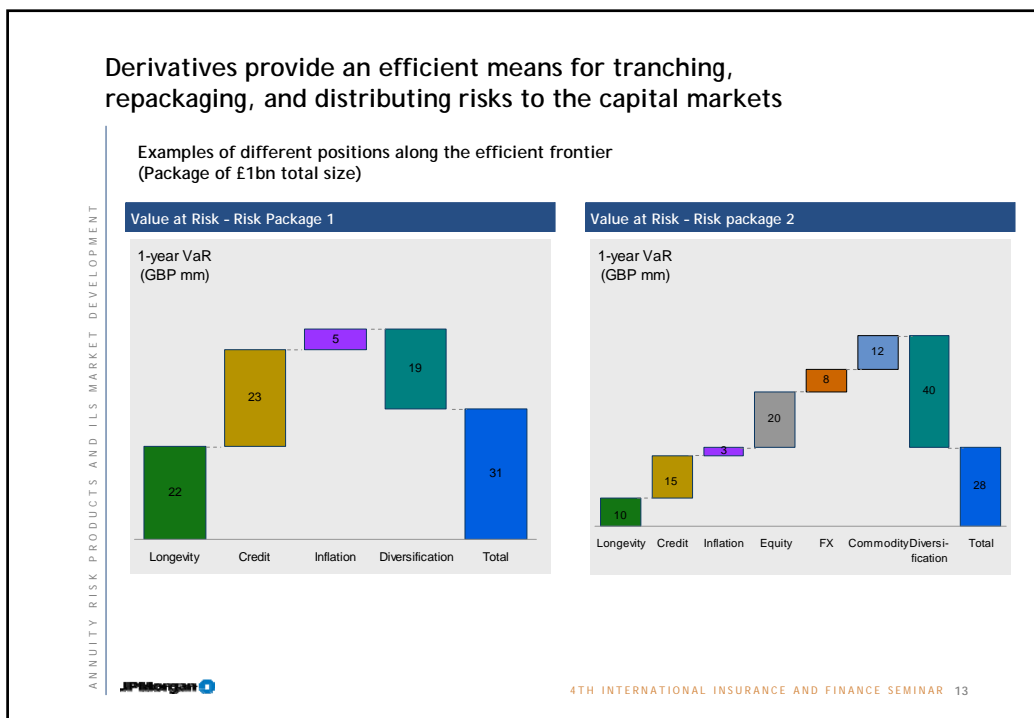
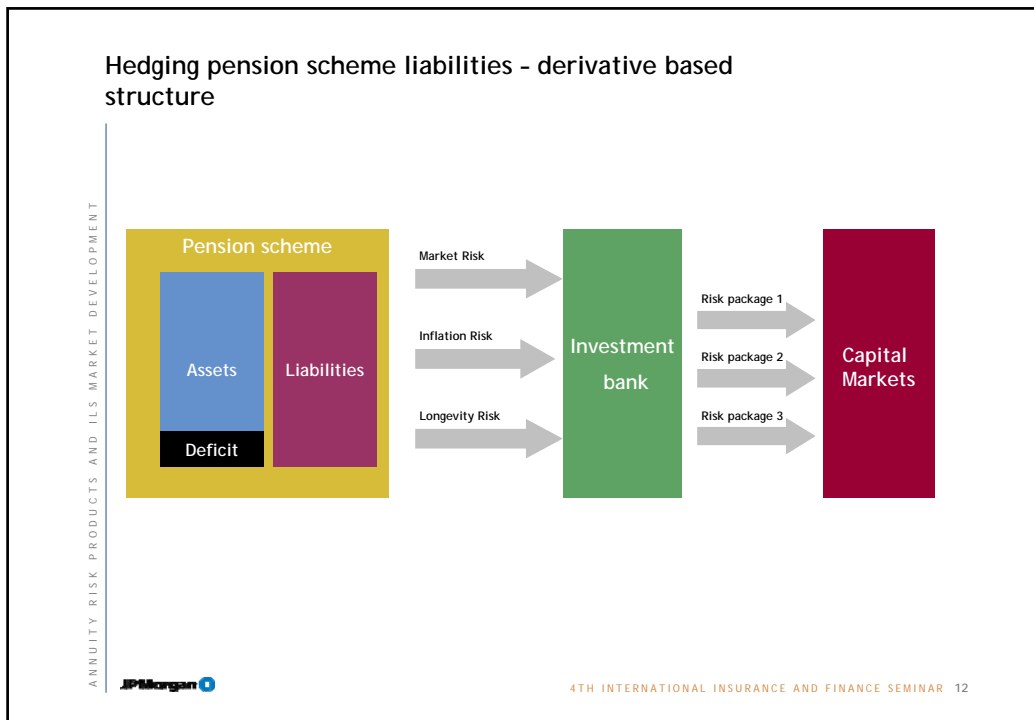
National Population mortality rates

Males	Females
50 yr	50 yr
:	:
60 yr	60 yr
:	:
70 yr	70 yr
:	:
80 yr	80 yr
:	:
90 yr	90 yr
:	:



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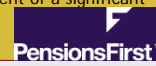
New capital market developments for annuity and longevity risk products

“Firm claims pensions revolution - Nov 5th 2007” **theguardian**

“Given recent market turmoil, many investors are reviewing asset allocation strategies, with a heavy emphasis on transparency, lack of exposure to refinancing risk, and low correlation . . . PensionsFirst is now launching a family of capital notes offering a new asset class that meets all of these criteria . . .”

“. . . we are confident there is now enormous potential for the development of a significant market in longevity securities”

Source: Pensions First Website



“Pension Insurance Corporation is a leader in the field of pension insurance, with a team that combines expertise across the full spectrum of relevant disciplines . . . In addition Pension Insurance Corporation has particularly strong securitization expertise, which enables it to use capital market structures for pension insurance solutions.”

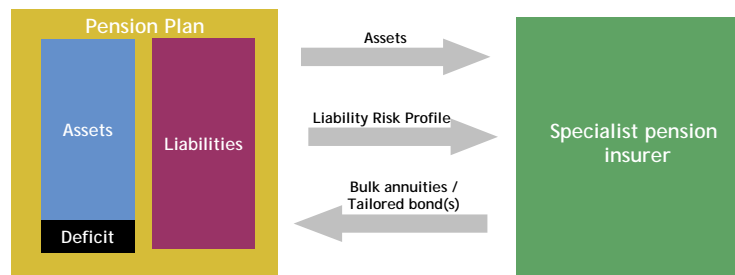
Source: Pension Insurance Corporation website

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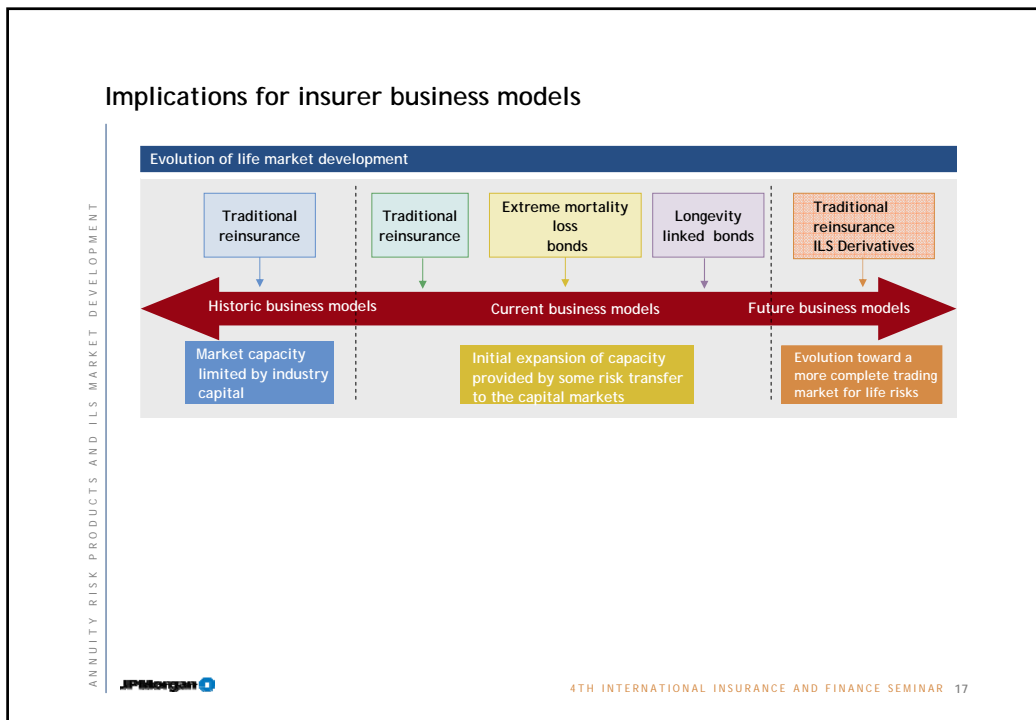
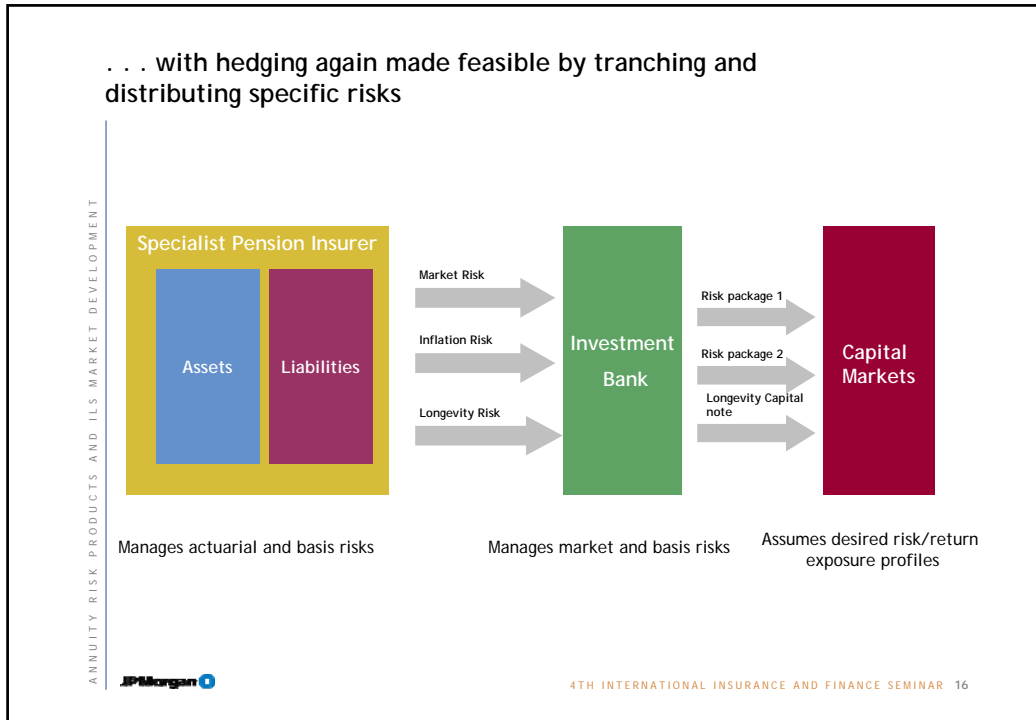
Hedging pension scheme liabilities - new bond structures similar to bulk annuities . . .



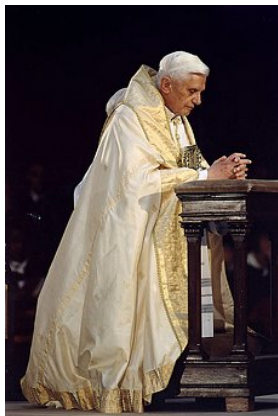
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What will be the next longevity product innovation?



- The focus is currently on the development of new instruments for effective longevity risk management
- Transfer of longevity risks to a wider group of agents in the capital markets remains the fervent goal among investment banks

"In the designs of providence, there are no mere coincidences"

Pope Benedict XVI

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