



Longevity Risk Hedging and the Stability of Retirement Systems

The Chilean Longevity Bond Case

Longevity 7 Conference

Frankfurt,
September 8, 2011

TREASURY
THE WORLD BANK

A Longevity Bond for Chilean Life Insurers

Lessons Learned

On Future Longevity Risk Hedging Solutions

A Longevity Bond for Chilean Life Insurers

Lessons Learned

Future Longevity Risk Hedging Solutions

A large, central, and competitive annuity industry

The 1981 Pension Reform resulted in a move from a public Pay As You Go system to a Fully Funded, Defined Contribution system with pensioners exposed to market and longevity risk.

Annuities play a central role. 60% of all pensioners have an annuity (one of the highest rates in the world). Annuitants are insured against market, inflation and longevity risk.

17 life insurance companies are aggressively competing for the distribution of annuities. **Annuities make 80% of their aggregate balance sheet. Assets are 20% of Chile's GDP.**

The **very competitive annuity market** allowed Chilean annuitants to get good value for their premiums. It is a rapidly growing market.

With a need for efficient stabilization policies and tools

The general objective for the government and the regulators is to ensure the financial stability of a young and growing market for retirement products which started from a low initial base.

Life insurance firms are exposed to market risk (duration mismatch) and longevity risk.

Longevity risk is the most difficult issues. It requires a strong data infrastructure, the ability to track mortality improvements and reflect them in capital and product regulation.

Average money's worth ratio (Expected Present Value of Annuity Payouts to the Premium) at 1.04 – 1.06 in recent years versus an international average of 0.9 – 1 for nominal annuities

Source : World Bank Report, Developing the Market for Retirement Products, the Case of Chile, January 2006



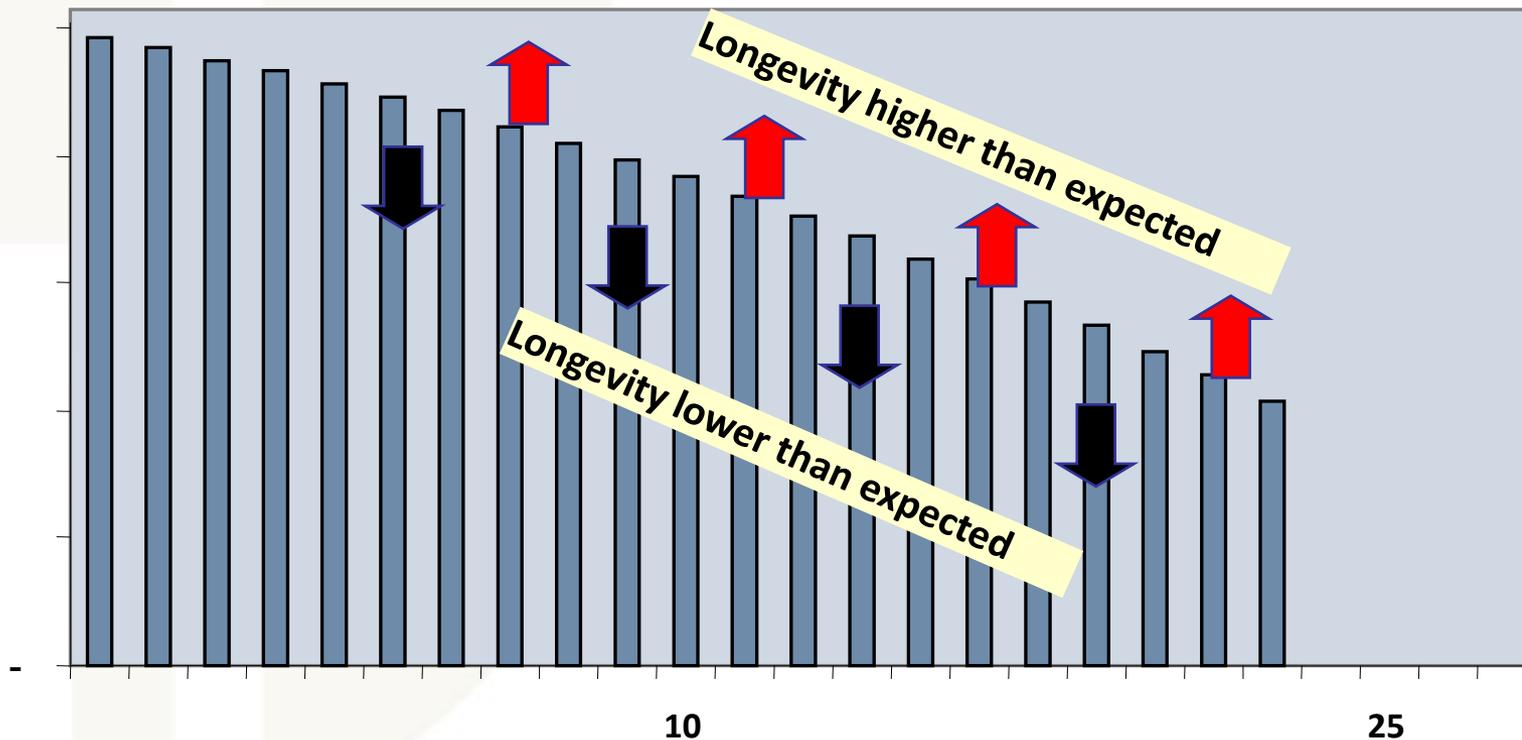
Annuities :
80% of life insurers B/S
16 % of GDP

Close Collaboration with the Regulatory Agency SVS

Initial discussion in 2006 with the Regulatory Agency, *Superintendencia de Valores y Seguros*, and a WB expert who worked on the Chilean retirement system. SVS was willing to develop risk management and enhance price transparency for longevity risk. The involvement from the regulator from the beginning was key (a lesson from the BNP EIB failed UK longevity bond in 2005)

A Cash Flow Hedging Structure

Initial Model: 25-year maturity cash flow hedge embedded in a World Bank bond with pay offs based on future actual Cumulative Survival Rates of a specified set of annuitants. First failed attempt with BNPP in 2008, attributed to the high hedging/funding cost. We came back with JP Morgan in 2009 with a most cost efficient structure.



A Mortality Table of all Annuitants administered by SVS

Established in the mid 80s, gathering annuitants mortality data of all life insurance companies

The mortality table updated in 2004 (RV 04) is based on data collected since 1995, with a methodology for calculating mortality rates.

The mortality table **would allow to compute pay offs based on the Cumulative Survival Rates (CSRs)** in a reliable and transparent manner

It would allow applying **actuarial methodologies to produce future estimated CSR values** and derive the value of the Longevity bond.

While estimates could differ according to expectations in a market context, the elements of the calculation would be transparent

A Regulation Reflecting longevity risk

Rule for calculating **Technical Reserves (CALCE rule) plus minimum regulatory capital for longevity risk** – 6% of Technical Reserves. SVS potentially ready to half the regulatory capital on hedged annuities

Cost Efficiency, Transparency and Capacity Building Objectives

Competitive selection of the reinsurer providing the longevity hedge

Optimal selection of the set of annuitants (Index) to hedge

Cost efficient structure

Publication of market / index values, of methodologies

**SVS
Annuitants
Mortality
Table**



**Transparent
and Reliable
Pay Offs**



**Transparent
Valuation
(Methods /Data)**

**SVS
Regulation on
Annuities**



**Potential
Regulatory
Benefits given
Hedging**

A Longevity Risk Hedging product for Chilean Life Insurers

A UF-denominated amortizing bond with a maturity of 25 years

- Issued by a collateralized SPV
- Sponsored by the **World Bank** - also a counterparty to the transaction
- Structured by **JPMorgan**
- Hedged through a Longevity swap with **Munich Re** intermediated by World Bank
- Partnership with **SVS**

A Longevity Hedge

- Provides a hedge of longevity risk associated with insurer's annuity portfolio
- Specifically hedges the longevity risk associated with the **sub-group of the annuitant population corresponding to female spouses, or "beneficiarias"**
- Involves a "**Longevity Index**" of beneficiarias that determines the bond cash flows. Cash flows increase if *beneficiarias* live longer than expected and decrease if they live shorter than expected

An Attractive Investment

- Bond proceeds are invested in a **portfolio of government BTUs** (SPV collateral)
- Cash Flows match the longevity risk of the liability, with the security of Chilean government risk
- Structure provides a higher yield than BTUs which offsets cost of longevity hedge

A Source of Capital Relief

- Objective to provide **regulatory capital relief** as a benefit for longevity risk management

Hedge Based on a Longevity Index



- Hedges the cash flow risk related to female spouses, or “beneficiarias”
- The life insurance company receives payments each year equal to the level of a Longevity Index of “beneficiarias”

- The longevity index is an index of those beneficiarias in a particular cohort who are alive and receiving an annuity (pension) at any time over the life of the bond

- At any time, current annuitants include:

- **Initial Annuitants:** Beneficiarias who are widows and receiving an annuity at start of the Index
- **Later Annuitants:** Beneficiarias who were not initial annuitants, but whose husband has subsequently died and are now annuitants

- The cohort refers to the closed group of beneficiarias who are initially aged **60-85 years old** at Inception Date

- The maximum age is 90¹

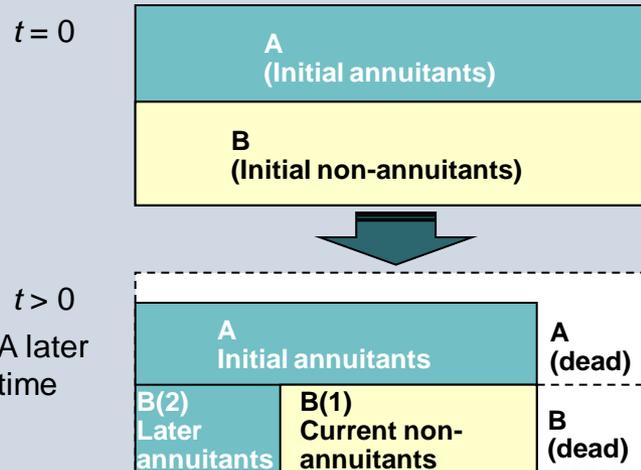
- The index is based on SVS annuitant data

- The index is weighted by the amount of each beneficiaria’s annuity payment

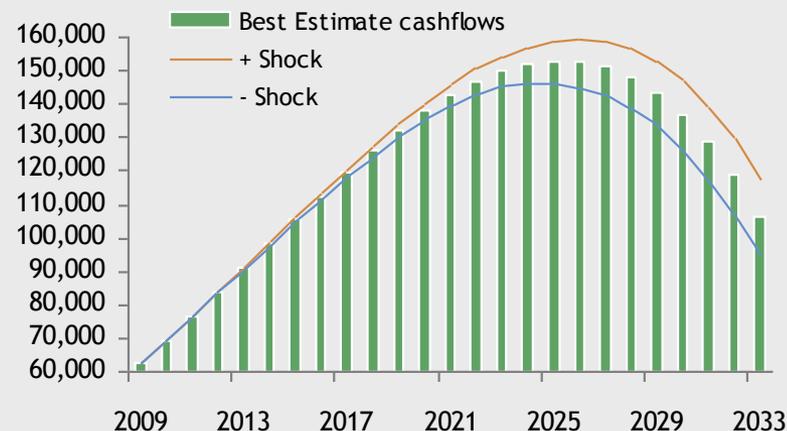
- ¹ When the age of a particular cohort increases above 90 they drop out of the index

Sub-groups of the reference population

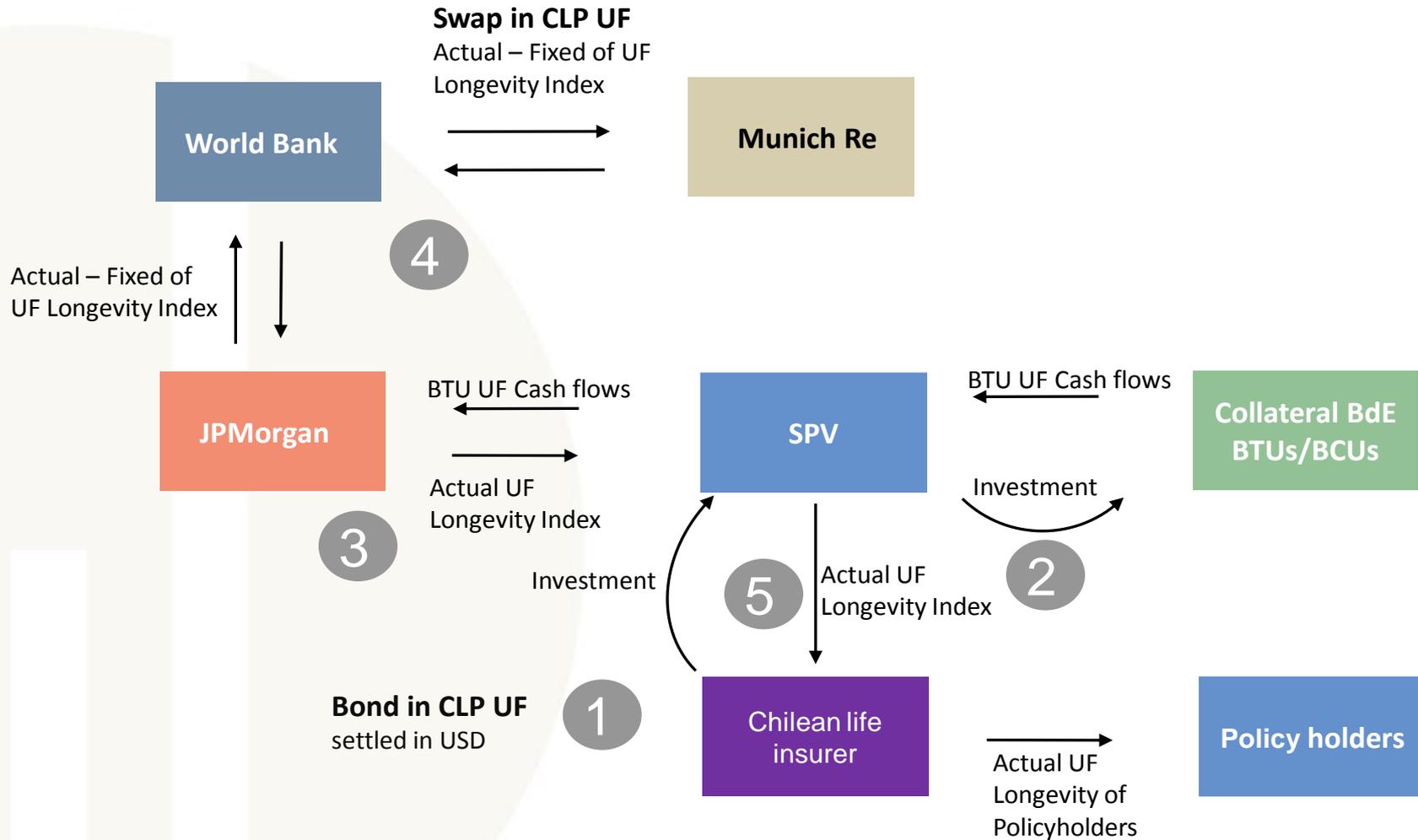
Inception of index



Result in “best estimate” UF annuity cash flows



Longevity Bond Structure



BTUs (Boons de la Tesoreria) are Chilean government issued UF linked bonds



39-bp spread above Chilean government after longevity insurance cost

Yield enhancement comes from the credit spread in collateral and from regulatory capital reduction

Annual return (in UF)

BTU 38s Yield (31% of Total Notional)	[3.09%]
BTU 28s Yield (39% of Total Notional)	[3.11%]
BCU 18s Yield (30% of Total Notional)	[3.13%]
Market Weighted BTU Portfolio Yield	[3.11%]
Gross investment yield of annuity	[3.60%]
Cost of longevity hedge	[-0.40%]
All-in longevity bond yield	[3.20%]
Possible benefit from lower regulatory reserves	[0.30%]
All-in return for insurer	[3.50%]

39bps pickup over Bonos

Notes

- JPMorgan manages the cash flow mismatch between the BTU/BCU collateral portfolio and annuity cash flows
- Collateralized by bonds issued by a Chilean government owned bank: **Banco del Estado**
- Cost of longevity hedge based on indicative pricing from Munich Re
- Cost of capital benefit applicable to the portion of longevity risk that is hedged. Assumes 50% reduction in longevity capital requirement by the SVS (from 6% of technical reserves to 3%) and insurer cost of capital of 10%

A Longevity Bond for Chilean Life Insurers

Lessons Learned

On Future Longevity Risk Hedging Solutions

Chilean Life Insurers eventually declined to invest in the bond

- A collective decision, following a long period of dialogue with the WB, JP Morgan and SVS, with obvious signs of interest and extensive questions

For the following reasons

- **Basis Risk:** each life insurance company had its own portfolio of annuity differing from the whole annuity portfolio in the SVS database
- The **high cost of the Longevity Insurance Premium**
- Their own **collective perception of Longevity Risk as a low risk**
- Some mentioned an **interest in having a custom-designed hedge**, possibly addressing the tail risk of groups of annuitants with ultra long longevity

And while some of them look weak

- **But Basis Risk was limited**, because of the specific context of Chile. JP Morgan had produced successful back testing using historical data from the SVS database as well as stochastic forward-looking analysis
- **Counterparty Credit Risk was also limited**, notably because of the involvement of the World Bank
- **The Cost of Longevity Insurance had been minimised** through competitive selection of the reinsurance company carrying the risk and through careful selection of the Hedged Population. Moreover the structure was paying a return over Chilean government bonds.

Some fundamental economic causes were at play

- **The structure was only intermediating reinsurance** and not capital market players
- **The structure was very long term**, therefore magnifying the cost of hedging
- The structure was designed for the whole sector and not bespoke
- There could have been **moral hazard and a lack of market forces as an incentive to hedge** as well in the dynamics of the collective decision

Good economic rationale for longevity risk securities and hedging instruments

- For the same reasons that explain catastrophe bond markets
- There is an economic need to manage a large-scale risk, which cannot be diversified away within a country, and for which there is currently a limited capacity for diversification on a worldwide basis offered by the global reinsurance sector.
- On the other hand there is demand from institutional investors for uncorrelated assets yielding higher returns

Longevity swap market, longevity bond transactions, Lifemetrics indices, the LLMA

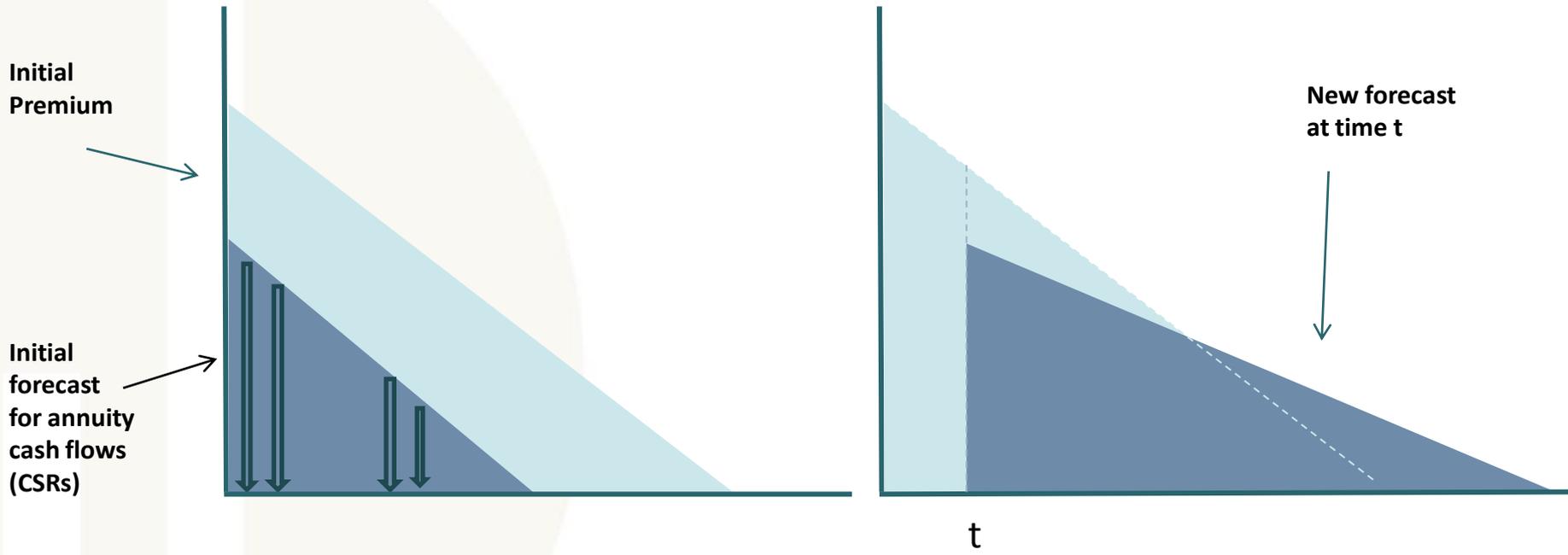
- The UK market for longevity swaps compares in size and activity to the UK market for buy ins/buy outs
- **£4.1bn in 2009, £3.0bn in 2010, £1.8bn in 2011 to date**
- In 2010 Swiss Re launched the **\$50m Kortis series** as a securitization transaction
- The market is in the process of building standards: longevity risk models(RMS), legal forms, etc.
- Transactions have been mostly designed for one insurance buyer so far

The Chilean Longevity Bond as standard and infrastructure for the annuity sector in Chile

- One of the major elements was **the regular publication of a value, based on a publicly available methodology**
- The Longevity Bond was also designed in a way that made it a hedging instrument for every life insurance company in Chile
- So the bond was distributed to all potential buyers of protection (all life insurance companies exposed to the same risk in a systemic fashion) and could then have been traded among them

Periodic publication of a price based on a public methodology

The case of the Longevity Swap



$$V_t = IE \left\{ \sum_{i=1}^T \frac{\tilde{S}_t^i - S_0^i}{(1+r_t^i)^i} \right\}$$

with S_t^i Cumulative survival rate at time i measured (forecasted at time t according to a pre specified and publicly available method)

$$S_0^i = S^*{}^i_0 + \pi^i$$

Cumulative survival rate at time i fixed at time 0 as: forecast plus premium

A Longevity Bond for Chilean Life Insurers

Lessons Learned

On Future Longevity Risk Hedging Solutions

Demand from Capital Market Investors

- Foster participation beyond reinsurers and specialized funds. Make banks, insurance companies and asset managers comfortable with products they are used to: **investors prefer bonds**
- Stay to the extent possible in their maturity range: **maturities between 5 and 10 years**
- **Offer a strong credit** or collateral together with longevity risk
- Offer a robust legal and **valuation framework**
- Provide **risk modelling capacity for forecasting and assessing longevity risk**
- **Standardize** product to make it more liquid, Support the **liquidity in the** secondary market, price transparency

Supply from Longevity Insurance Buyers / Longevity Bond Sponsors

- **Standardize product:** legal documentation, indexes to cover a sector/economy: indexes, structure/form of bonds
- Encourage investment banks to structure specific **bespoke overlay solutions for basis and tail risk**
- Offer **high quality counterparty credit risk** (can be collateral in a swap or bilateral contract)
- Have Legal, accounting and regulatory **authorities acknowledge the effect of the hedge**
- Offer **hedging solutions in Marked to Market**, consistent with accounting rule
- Encourage the use as Securitization tool by (re)-insurance

Market Infrastructure

- **Support Risk Modelling activity and common language for pricing and rules for pay offs**
- Encourage active Secondary Market by dealers
- Make pricing and modelling parameters public
- Build on **example of Cat Bond Markets**
- Encourage the pooling of Longevity Risks from different countries / regions (diversification) on a global scale

treasury.worldbank.org

TREASURY

THE WORLD BANK

Thank you for your attention

Izelenko@worldbank.org