The economics of sharing macro-longevity risk

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Fifteenth International Longevity Risk and Capital Markets Solutions Conference, 12th September, 2019

Relevance

The anticipated increase in longevity and resulting ageing populations is the financial equivalent of climate change

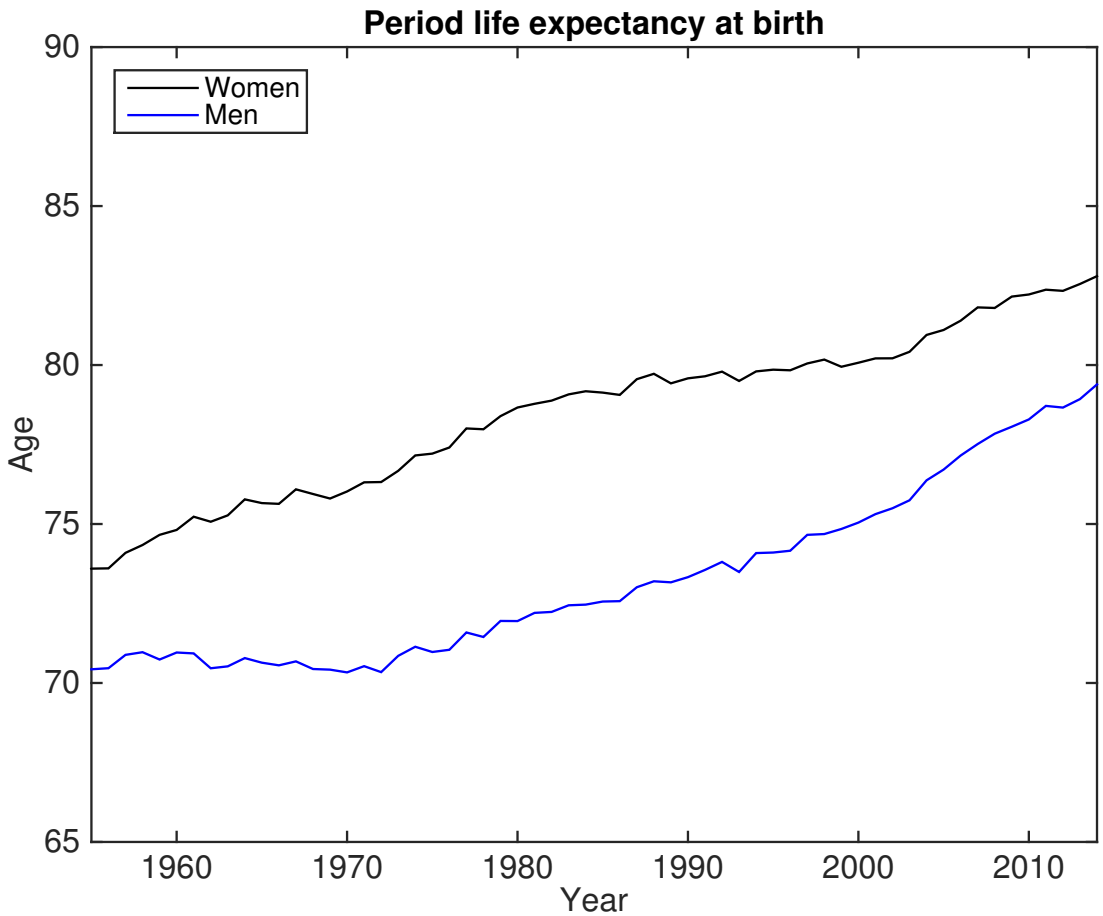
Michael Drexler, Head of Financial and Infrastructure Systems, WEF

Key messages

- Managing longevity risk is key in retirement provisioning
- We approach an actuarial topic from an economic perspective
- Risk sharing between cohorts yields welfare gains
- Optimal risk sharing rule depends on retirement age policy

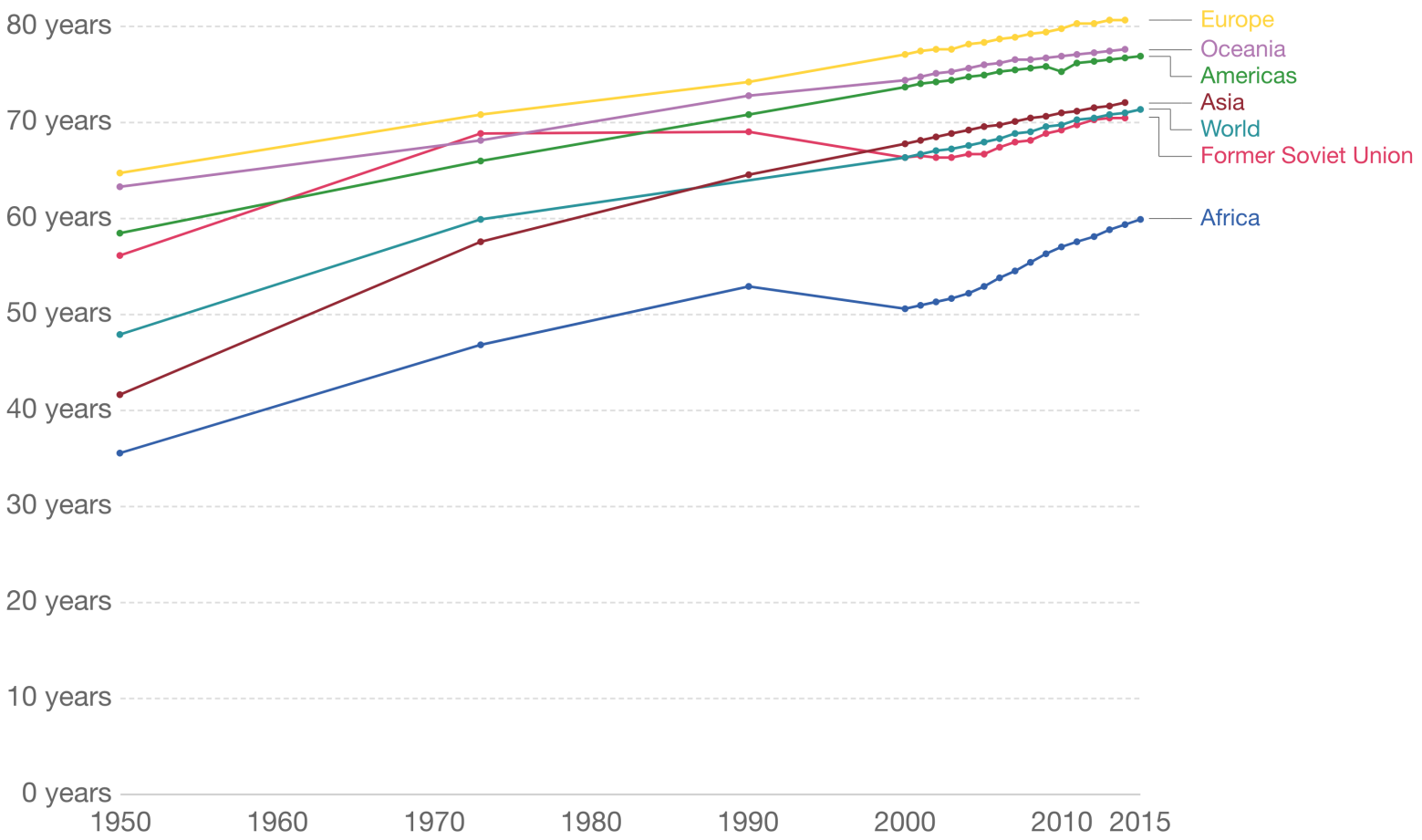
  Young cohorts absorb risk from retirees if the retirement age is linked to life expectancy

Life expectancy increased with 3 months per year during the last decades



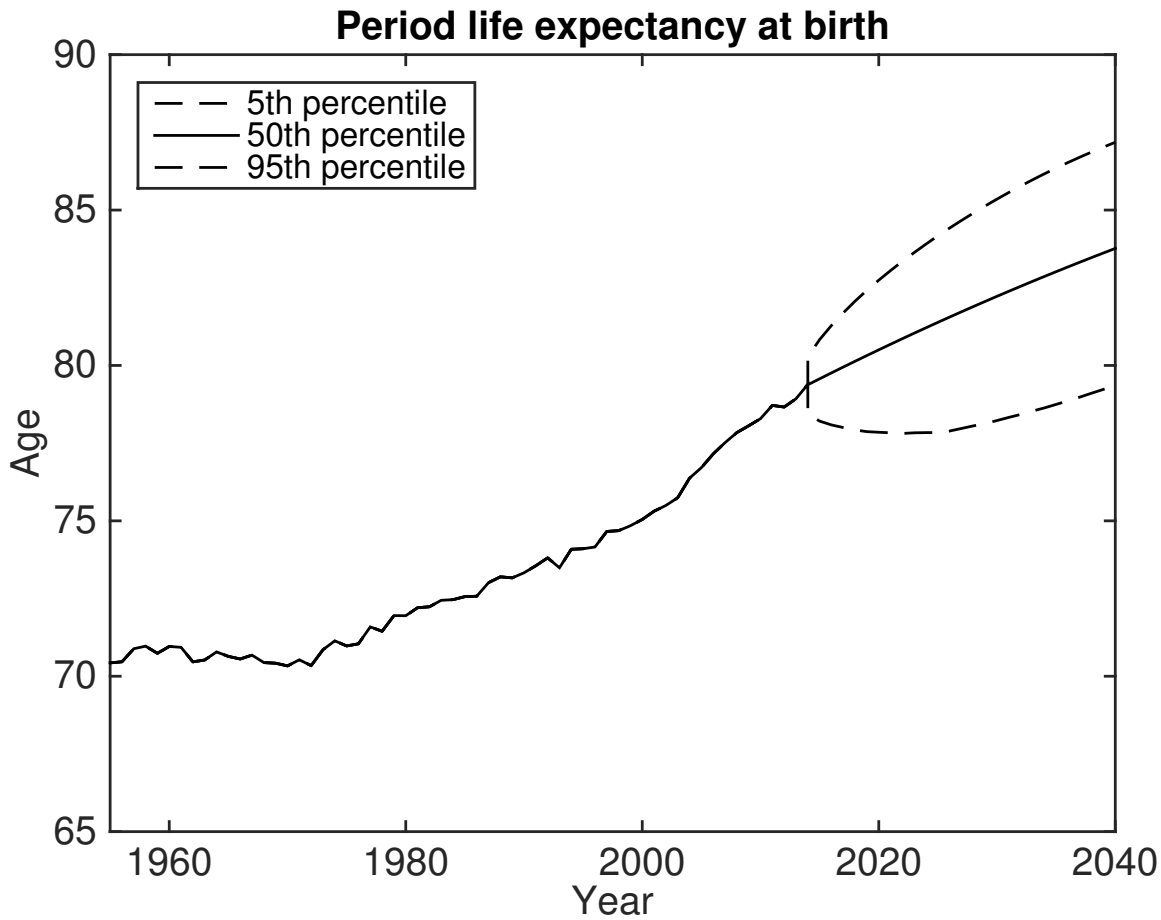
Source: Human Mortality Database

Increasing life expectancy is a worldwide phenomenon



Source: https://ourworldindata.org/

Life expectancy can decrease or increase due to, e.g., obesity or medical innovations



Source: Human Mortality Database

We focus on macro-longevity risk

- **Macro-longevity risk**: collective uncertainty about future mortality rates
  - Impact depends on age and this risk does not decrease with the number of participants in the pool (systematic risk)
- **Micro-longevity risk**: individual uncertainty about time of death
  - Impact increases with age but decreases with the number of participants in the pool (idiosyncratic risk)

Motivation research

Economic problem

Macro-longevity risk is a major risk for participants in a pension fund. They cannot easily trade this risk on financial markets.

Adequate risk sharing is welfare improving for two reasons

- Market for longevity risk is close to absent
- Cohorts are affected differently by longevity risk

Focus paper: optimal longevity risk sharing between cohorts in a pension fund using welfare analyses.

Other ways to manage macro-longevity risk

- **Insurance**
  - Securitization

    Cairns et al. (2006), Blake et al (2006), Ngai and Sherris (2011), Hunt and Blake (2015)
  - Issuance longevity bonds by government

    Brown and Orszag (2006), Blake et al. (2014)
  - Buy-outs and buy-ins

    Lin et al. (2015)
- **Natural hedging**

  Cox and Lin (2007)

Modeling and impact longevity risk

- Workhorse model: Lee & Carter model (1992)

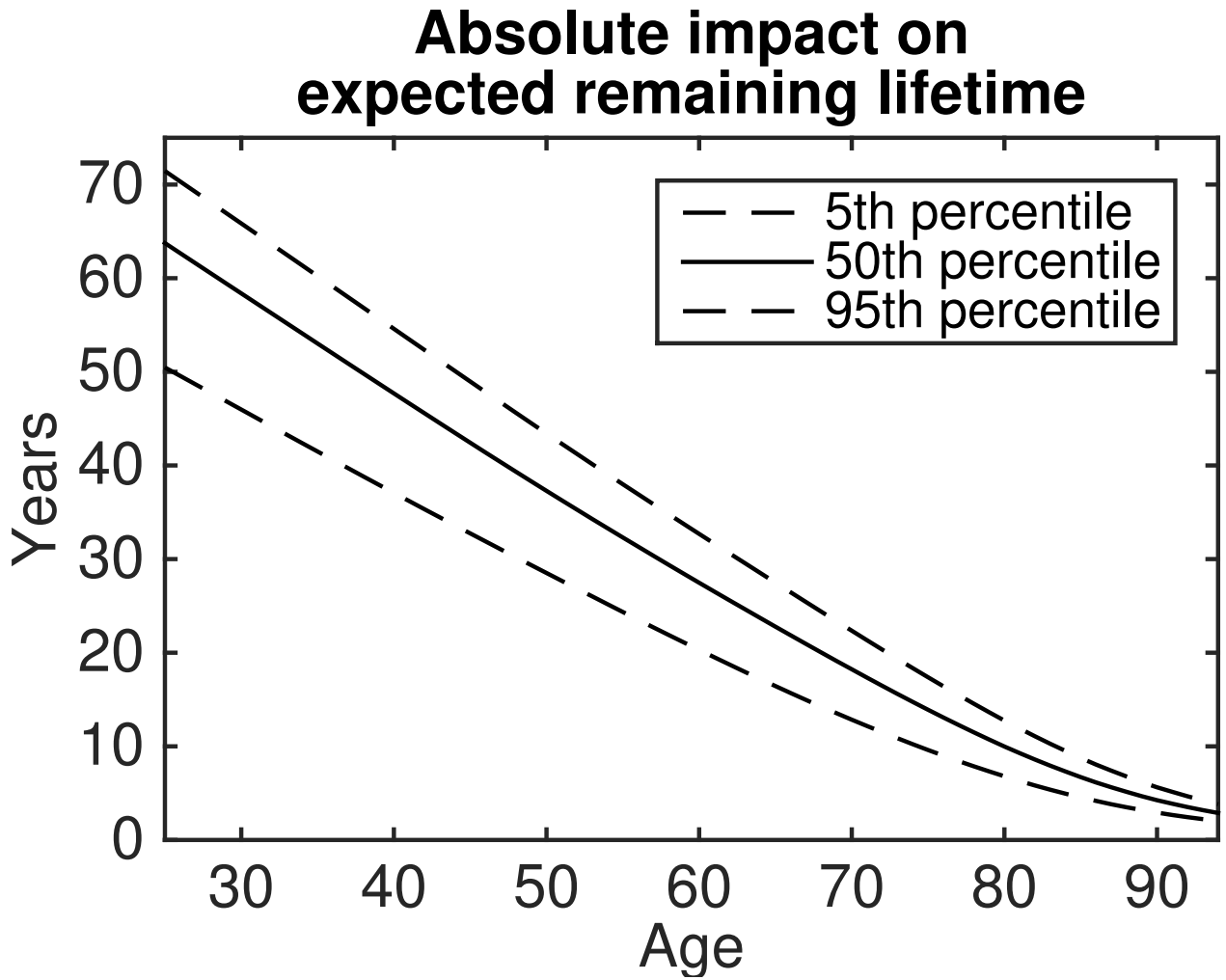
  Fit to historical data (Human Mortality Database)

- (Deferred) variable annuity as measure of consumption

  Interest rate $r = 2\%$ and retirement age $R = 67$

- 10-year longevity shocks

Impact longevity risk decreases with age



Retirement age policies

- **Fixed retirement age (FRA)**, e.g., US
  Constant working period
- **Partial adjustment retirement age (PARA)**, e.g., UK
  Constant retirement consumption
- **Fully adjusted retirement age (FARA)**, e.g., Netherlands
  Constant retirement period

Impact unexpected increase life expectancy

	Working period	Retirement period	Retirement consumption	Value annuity	Wealth at retirement
FRA	constant	++	-	++	constant
PARA	+	+	constant	+	+
FARA	++	constant	+	-	++

Pareto-efficient risk sharing

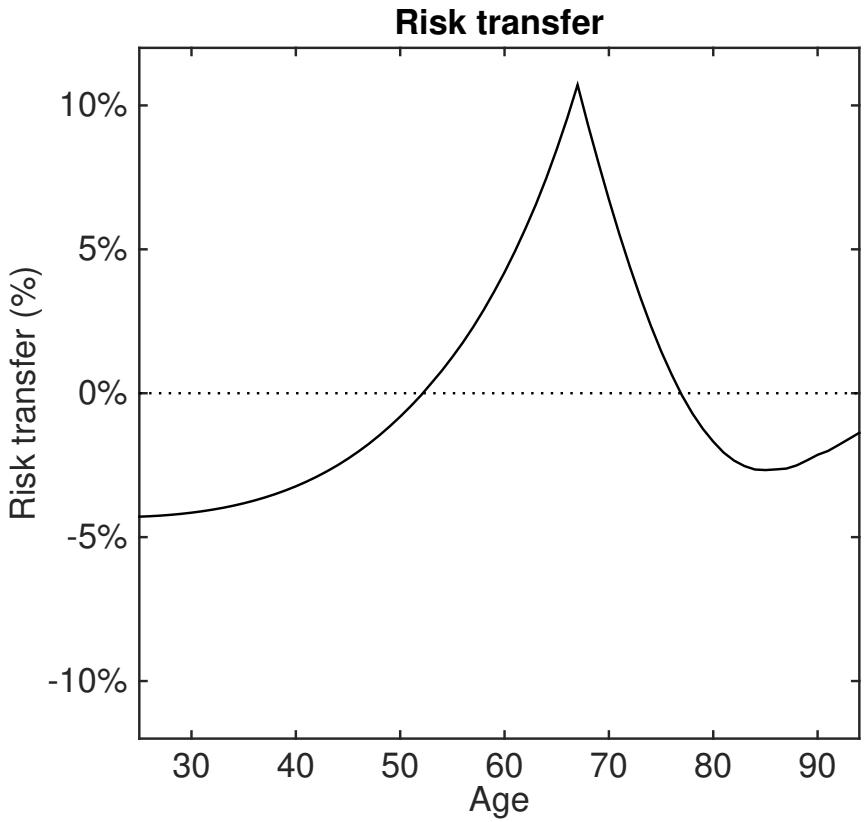
- Two ways to evaluate Pareto-efficient risk sharing
  - **Social planner who maximizes total welfare and reallocates risk**
  - Look for equilibrium
- Linear risk sharing rule
- Utility-based fairness criterion

We present the results in three dimensions

	FRA	**PARA**	**FARA**
Risk-sharing rule	Slide 16	Slide 17	Slide 18
Risk premium	Slide 19	Slide 20	Slide 21
Welfare gain	Slide 22		

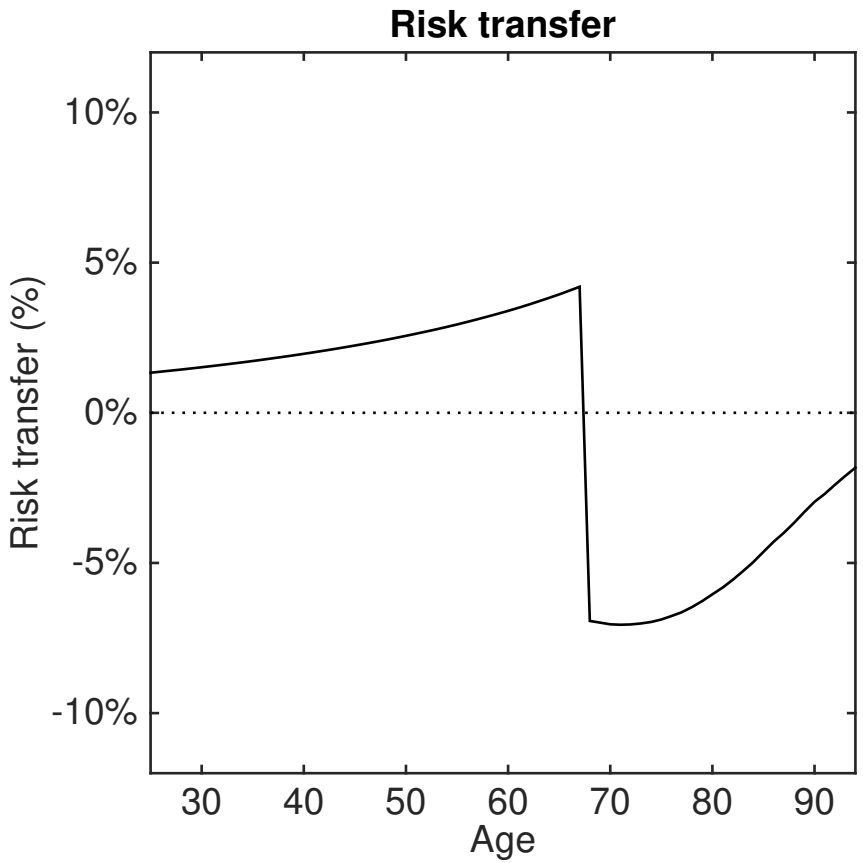
Cohorts around retirement absorb risk

Fixed retirement age (FRA)



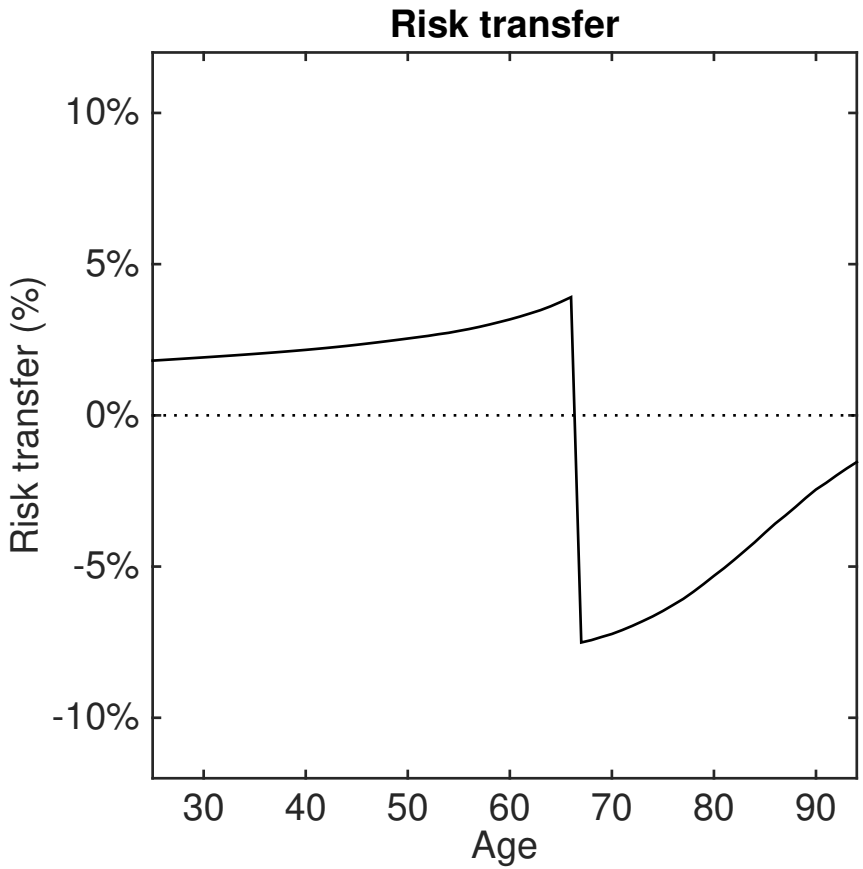
Workers absorb risk from retirees

Partial adjustment of the retirement age (PARA)



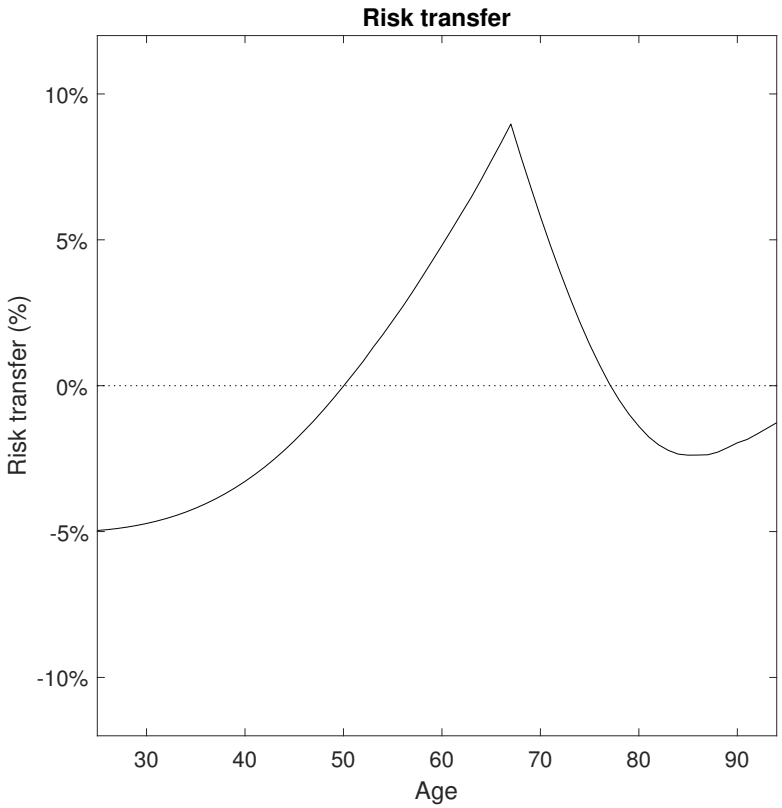
Workers absorb risk from retirees

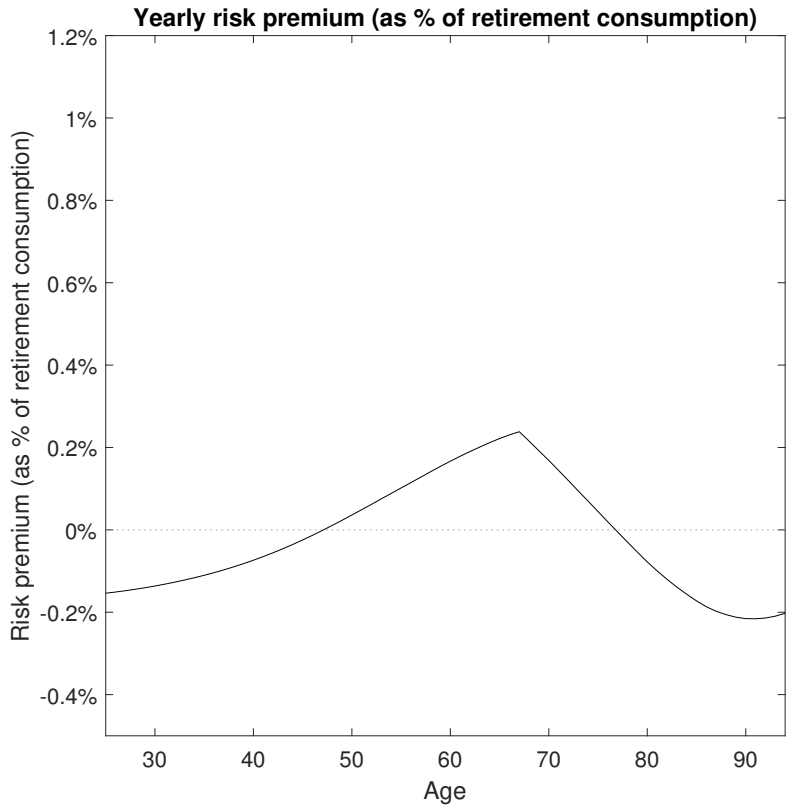
Full adjustment of the retirement age (FARA)



Cohorts who absorb risk receive positive risk premium

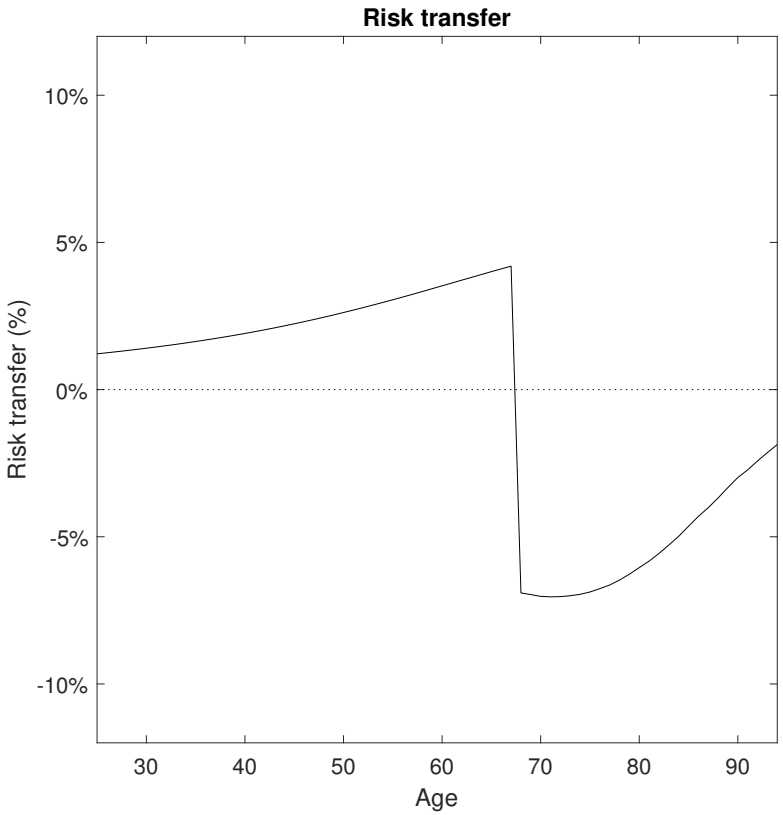
Fixed retirement age (FRA)

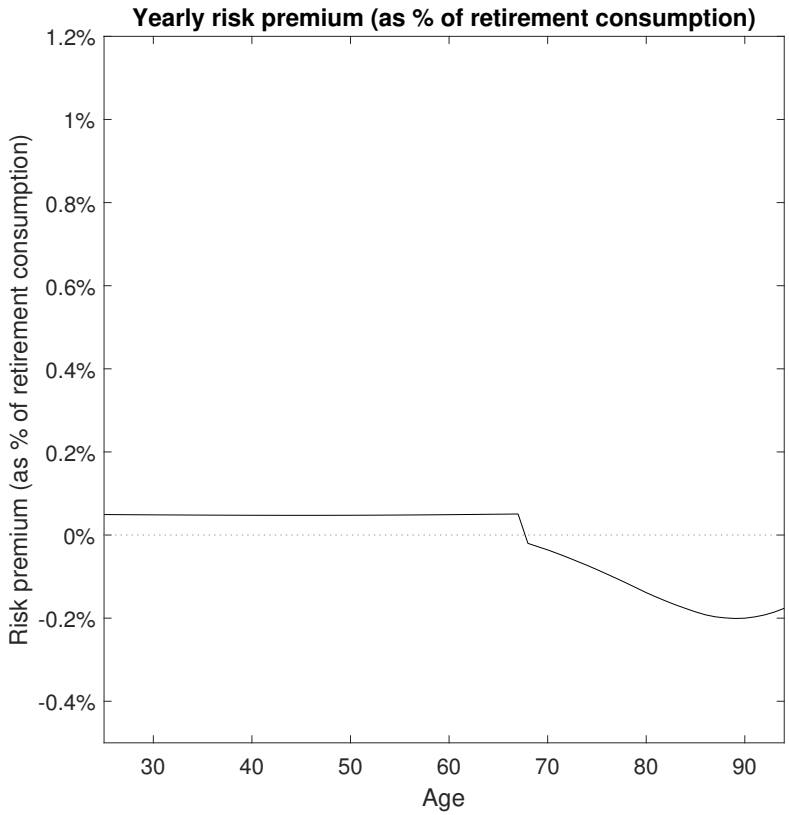




Cohorts who absorb risk receive small risk premium

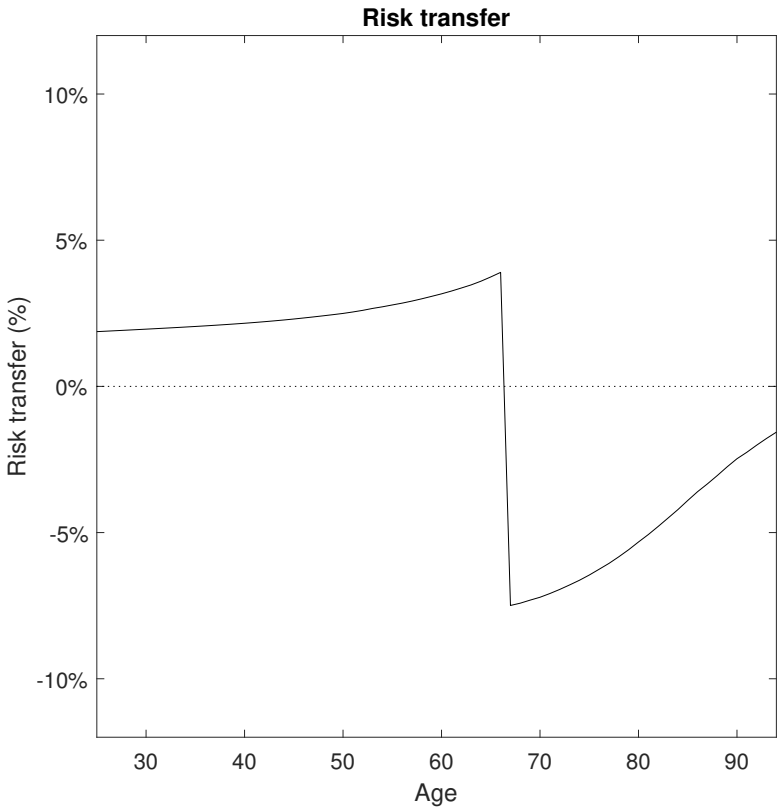
Partial adjustment of the retirement age (PARA)

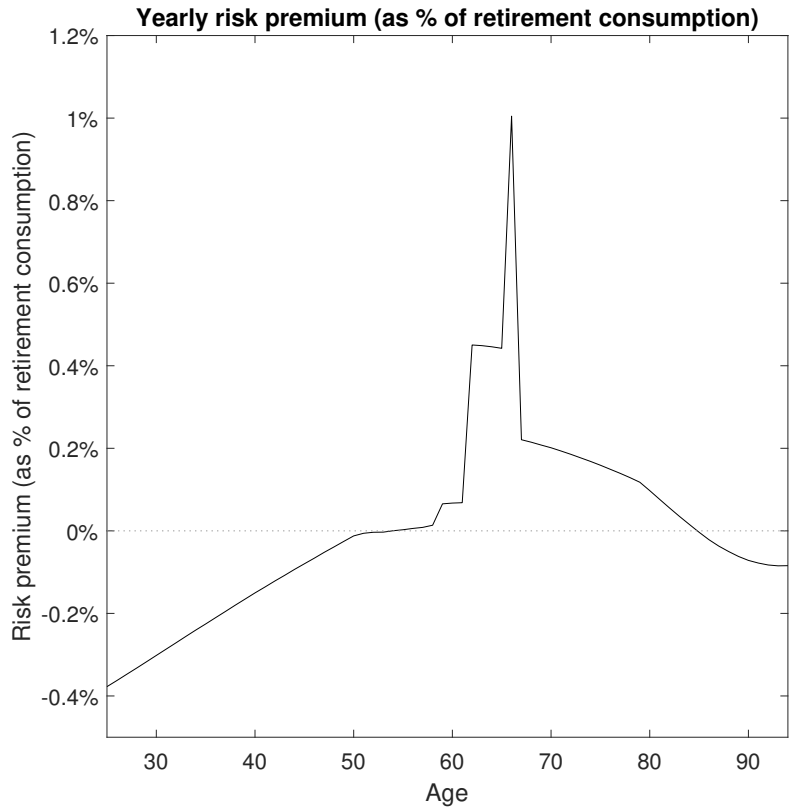




Young cohorts do not require a positive risk premium

Full adjustment of the retirement age (FARA)





Linking retirement age to life expectancy increases welfare gains up to 2.7%

Fixed retirement age (FRA)	0.3%
Partial adjustment retirement age (PARA)	0.5%
Full adjustment retirement age (FARA)	2.7%

Large welfare gain is a result of large risk-bearing capacity workers

In case of a full adjustment of the retirement age

- Workers use labor supply as hedge
- Workers are willing to provide insurance to retirees

Conclusion

- Risk sharing between cohorts yields welfare gains
- Optimal risk sharing rule depends on retirement age policy
- Optimal risk-sharing rule robust to data and model
- Managing longevity risk is key to a sustainable pension system