Individual post-retirement longevity risk management under systematic mortality risk

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Individual post-retirement longevity risk management under systematic mortality risk

Topic Coverage

Background

Optimal longevity insurance: two-period model

Longevity insurance: multi-period scenario and portfolio analysis

Results

Summary and conclusions
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Motivation

- Increasingly complex post-retirement financing decision

- Recent product innovations:
  - Deferred annuities (Post, 2010; Stevens, 2010; Horneff et al., 2010a)
  - Variable annuities (Doyle and Piggott, 2003; Milevsky and Kyrychenko, 2008; Horneff et al., 2010b)
  - Inflation-indexed annuities (Brown et al., 2002; Mitchell, 2002; Doyle and Piggott, 2003)
  - Group self-annuitization plans (Valdez et al., 2006; Stamos, 2008; Qiao and Sherris, 2011)

- Varying product costs and guarantees

- Significant systematic component of longevity risk reducing effectiveness of traditional mortality pooling
Summary

- We assess post-retirement strategies for an individual facing idiosyncratic and systematic longevity risk and inflation risk
- Concepts of optimal insurance (Borch, 1960; Arrow, 1971, 1973; Raviv, 1979) are applied to construct portfolios with differing levels of systematic and idiosyncratic longevity risk
  1. Theoretical framework based on state-contingent consumption and complete markets: Optimal longevity risk management strategy
  2. Multi-period simulation based on stochastic economic variables and stochastic mortality with systematic and idiosyncratic risk: Assess a broader range of retirement strategies
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Key Results

- Systematic longevity risk matters
- Optimal insurance concepts are useful

- No loadings, no bequest: annuitization strategies including GSA plans are optimal
- With loadings on life annuities: mutual, non-guaranteed GSA products replace annuitization, even inflation-linked annuities
- With bequest: coinsurance portfolio strategies with self-annuitization and GSA’s
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A two-period expected utility model

- Idiosyncratic and systematic longevity risk
- Four products: risk-free investment, a life annuity, a longevity bond, and a GSA fund

<table>
<thead>
<tr>
<th>State</th>
<th>Risk-free bond</th>
<th>Annuity</th>
<th>Longevity bond</th>
<th>GSA</th>
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<tr>
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- Product prices derived using a state-contingent claims approach, product risk premiums
Results of the two-period model

- Complete market, no bequest motive:
  - Full annuitization is the dominant strategy as in Yaari (1965)

- Complete market, bequest motive:
  - Life annuity demand reduced; risk-free bond provides bequest
  - Systematic longevity risk hedged with GSA and longevity bond

- Loading on the price of the life annuity:
  - Life annuity demand reduced, substituted with longevity bond and GSA

- Life annuity provider faces insolvency risk:
  - Similar to complete market case with bequest; small increase in annuity demand

- The optimal portfolio depends on the price for transferring systematic and idiosyncratic longevity risk
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Longevity insurance: multi-period scenario and portfolio analysis

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Multi-period numerical analysis

- Multi-period simulation model used to assess a range of alternative strategies based on optimal insurance concepts (coinsurance, deductible)
- Allow for inflation and real consumption with discounted expected utility with and without bequest
- Extended products and portfolios: fixed life annuities, deferred annuities, inflation-indexed annuities, group self-annuitization (GSA), and self-annuitization
- Simulate stochastic economic variables and stochastic mortality with systematic and idiosyncratic risk
Stochastic building blocks

- Mortality model: based on Wills and Sherris (2010)
- Market model: cointegrating vector error correction model with regime switching (RS-VECM) (Ngai and Sherris, 2011)

Figure: Survival curve and annuity values, 65-year-old male with confidence intervals.
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Certainty equivalent cash flow: portfolios

- Age = 65, $\beta = 0.98$, $\delta = 2$, wealth = $75,000$, no bequest, no loadings
Results: no bequest, no loadings

- Results for the base case (age = 65, $\beta = 0.98$, $\delta = 2$, wealth = $75,000$, no bequest, no loadings):
  1. 100% inflation-indexed annuity
  2. 100% life annuity
  3. 100% GSA

- Full annuitization, inflation-indexed annuities preferred, GSA because of systematic longevity risk

- Similar results for different wealth levels and different ages
Certainty equivalent cash flow: loadings

- Age = 65, $\beta = 0.98$, $\delta = 2$, wealth = $75,000$, no bequest
Results: guarantee product loadings, no bequest

- Age = 65, $\beta = 0.98$, $\delta = 2$, wealth = $75,000$, no bequest
- 10% loading:
  1. 100% inflation-indexed annuity
  2. 100% GSA
  3. 100% life annuity
- 25% loading:
  1. 100% GSA
  2. 100% inflation-indexed annuity
  3. 35% life annuity, 35% GSA, 30% self-annuitization
- Increased role for mutual GSA and co-insurance
Results: bequest motive

- Age = 65, $\beta = 0.98$, $\delta = 2$, no loadings
- With bequest motive:
  1. 35% life annuity, 35% GSA, 30% self-annuitization
  2. 50% life annuity, 50% self-annuitization
  3. 25% deferred annuity, 75% self-annuitization
- Increased role for self-annuitization through phased withdrawal products
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Conclusions

▶ For individuals with no bequest motive, and assuming no product loadings, annuitization strategies with small holdings of GSA plans are optimal under systematic longevity risk.

▶ With loadings on guaranteed life annuity products, GSA plans which are mutual and non-guaranteed, are included in an optimal strategy for individuals to manage their post-retirement longevity risk, replacing even annuitization products with inflation guarantees.

▶ For individuals with a bequest motive, portfolio strategies including self-annuitization and GSA’s dominate full annuitization.
Thank you very much!

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Summary and conclusions

References