Portfolio Insurance Strategies for Target Annuitisation Funds

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Outline

Topic Coverage

Motivation

- The provision for retirement benefits around the world is shifting
  - unfunded public pension $\rightarrow$ private funded schemes
  - defined benefit (DB) $\rightarrow$ defined contribution (DC)

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- Provide sustainable income flows (Blake et al., 2008; Financial System Inquiry, 2014)
  - finance a desired consumption path
  - pension fund managers have no liability
  - target annuitisation fund (Impavido et al., 2012)

Investment objective

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- In contrast to BlackRock CoRI^{TM} Retirement Indexes
  - cost of a lifetime annuity for an individual with an average life expectancy

Investment strategies

From the perspective of a fund manager

- Optimal investment strategies with minimum guarantee
  - Battocchio and Menoncin (2004)
  - Cairns et al. (2006)
- Portfolio insurance strategies to limit the downside risk
  - option-based portfolio insurance (OBPI)
  - constant-proportion portfolio insurance (CPPI)

Topic Coverage

The financial market

The real interest rate, r_t follows the Vasicek (1977) model

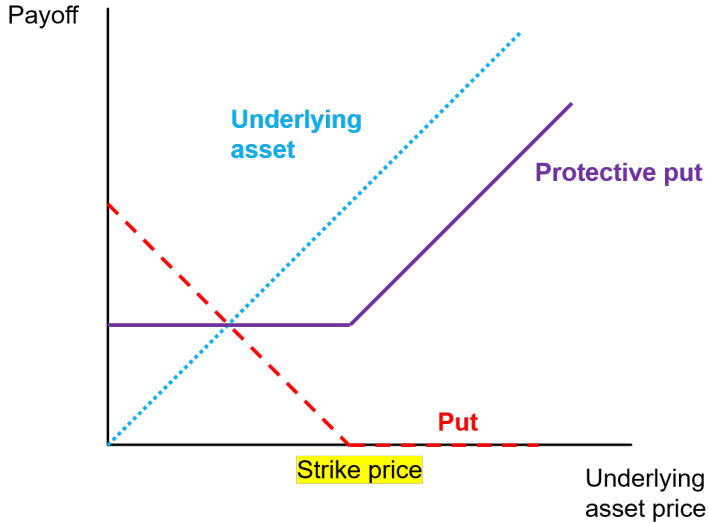
Three assets available

1. A cash fund
2. An equity fund (with dividend reinvested)
3. A bond fund with a constant maturity

Assume a deterministic contribution to the fund

Option-based portfolio insurance (OBPI)

Similar to a protective put strategy except for a stochastic strike price



Option-based portfolio insurance (OBPI)

- Price the option and find the hedging portfolio
  - change-of-numéraire technique (Geman et al., 1995)
  - price an option on a portfolio = price a portfolio of options with appropriate strike prices (Jamshidian, 1989)

Constant-proportion portfolio insurance (CPPI)

- The amount allocated to risky asset as the product of a cushion, C_t and a multiplier, m (Black and Jones, 1987)

$$e_t = mC_t = m(Y_t^{\text{CPPI}} - A_t)$$

- Assume the rest of the assets is invested in a portfolio that replicates the target, A_t

Topic Coverage

Numerical application

Parameter values

- Parameters representing the financial market
  - consistent with Brennan and Xia (2002)
- Multiplier in CPPI: $m = 1, 1.2, 1.4, 1.6, 1.8, 2.0$

Initial values

- Real interest rate 2.5%
- Equity fund price \$1,000
- Annual contribution \$7,000, increases at 2.5% p.a.

Average portfolio weights for OBPI

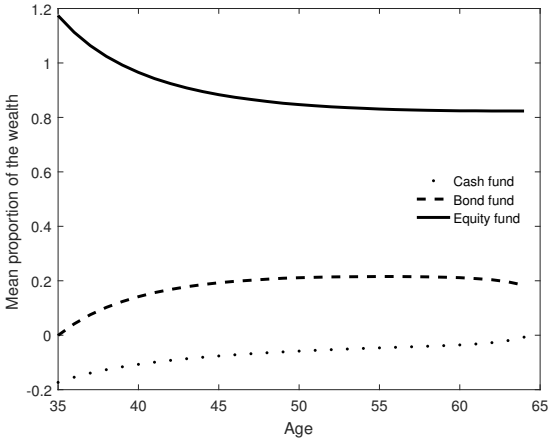


Figure 1: The average portfolio weights in each asset for the last 30 years before retirement for the option-based portfolio insurance strategy.

Average portfolio weights for CPPI

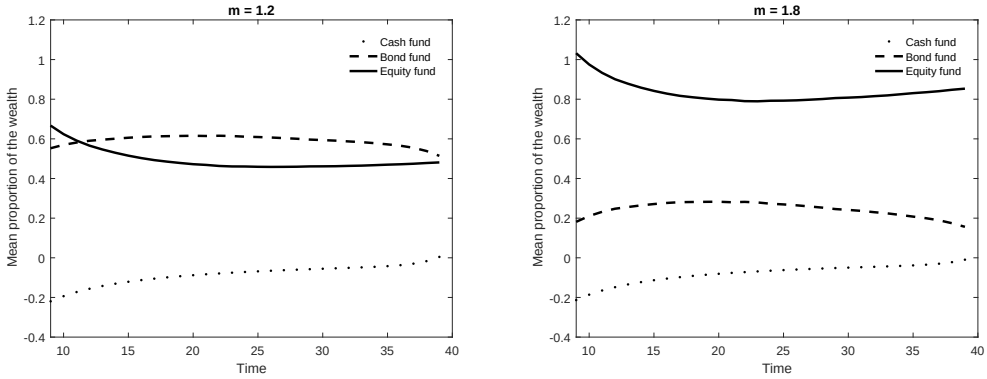


Figure 2: The average portfolio weights in each asset for the last 30 years before retirement for the constant-proportion portfolio insurance strategy with selected multipliers.

Payoff

- Portfolio insurance strategies provide good downside risk protections
- CPPI performs better than OBPI for higher portfolio value and lower shortfall probability

Table 1: Summary statistics of the target annuitisation level and the portfolio value at retirement.

	Mean ($000)	Std Dev ($000)	Median ($000)	Shortfall probability	Average shortfall ($000)
A_T	619.25	21.00	618.97	-	-
X_T^{OBPI}	2,586.48	3,281.26	1,528.00	0.09	-16.88
X_T^{CPPI}					
$m = 1.2$	1,386.38	1,324.70	993.93	0.004	-13.50
$m = 1.8$	3,106.34	9,071.32	1,158.36	0.02	-15.77

Topic Coverage

Conclusion

Portfolio insurance strategies for the target annuitisation fund

- A possible solution to linking the accumulation and retirement phases
- Both OBPI and CPPI provide good downside risk protection
- Average portfolio weights in the equity fund decrease over time
- CPPI performs better than OBPI for in downside risk protection

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