Variable annuities in collective pension schemes with risk sharing: valuation, investment and communication

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This paper explores collective pension schemes that provide (deferred) variable real annuities by sharing financial, inflation and biometric risks among the participants. These so-called *defined-ambition* schemes share risks on the basis of complete contracts. In particular, if the value of aggregate liabilities deviates from the value of total assets, the pension contract specifies how individual pension rights are adjusted so that liabilities match assets again and the aggregate value of pension rights equals total assets. Accordingly, mismatch risk is born by the participants on the basis of ex-ante rules rather than by a corporate sponsor (in corporate schemes), tax payers (in public schemes) or an insurance company. Pension rights are thus ambitions rather than guarantees. Indeed, real income streams during retirement are conditional on the actual and projected investment performance of the scheme, mortality rates of the participants and (wage) inflation.

The aspired annuities are indexed to wages or prices so that the nominal income stream is expected to grow over time. In case assets fall short of liabilities, annuities are not increased in line with the aspired indexation. Annuities are adjusted gradually after an unexpected shock that causes a mismatch between assets and liabilities. Hence, retirees can adjust their standard of living gradually.

The defined-ambition schemes we consider differ from traditional defined-contribution schemes in which individuals hold tradable financial assets. Among other things, risk management during the accumulation phase is based on the objective of providing a life-long income stream during retirement. Accordingly, inflation and interest-rate risks are actively managed during the accumulation phase. Moreover, in defined-ambition schemes participants can trade risk factors among themselves that are not yet traded on liquid financial markets (such as longevity and (wage) inflation). The prices of these risk factors traded within the mutual insurance vehicle are difficult to determine objectively.

The defined-ambition schemes are based on proposed risk-sharing systems in the Netherlands, and evolved from traditional defined-benefit schemes with (nominally) guaranteed pension rights. Also in public-sector pension schemes in the United States risk sharing is being considered as a way to reduce the liabilities to the sponsors of these schemes (see e.g. R. Novy-Marx and J. Rauh, 2012, Linking Benefits to Investment Performance in US Public Pension Systems).

Valuation

We show how these variable real annuities can be valued in a market-consistent fashion so that the transfer value is consistent with the value of the variable annuities provided. In particular, these (deferred) annuities are valued on the basis of the nominal term structure amended in two directions. First, a horizon-dependent risk premium that rises with the time horizon is added. Second, break-even inflation capturing the aspired indexation to inflation is substracted. The overall discount curve to be used is in between the expected return on the actual investment portfolio of the fund as a whole, on the one hand, and the real risk-free term structure, on the other hand. Indeed, participants can be viewed as having a combination of a hedge

portfolio that matches the aspired income stream in retirement and a speculative portfolio aimed at capturing the risk premium. The weights of the two portfolios depend on the investment horizon of the participant and yield a life-cycle pattern of investment in which young workers take more investment risk than retirees do.

Endogenous Investment policy and pension contributions

The paper discusses how the investment policy of the fund can be determined endogenously from specific desired risk profiles of the (deferred) variable annuities (including the preferred indexation of annuities to a particular price or wage index). The paper thus extends the principle of liability-driven investment to stochastic liabilities. Moreover, asset-liability management (ALM) is generalized to conditional liabilities. Indeed, the contract is complete also in terms of investment policy so that participants obtain the exposures that have been communicated to them. We show, however, that in linear contracts a change in collective investment policy does not affect the market value of individual pension rights.

We demonstrate also how pension contributions can be endogenously derived from the conditional pension promises (i.e. the pension ambitions). This is in line with the defined-benefit tradition in which the pension premium is determined by the costs of the aspired income stream in retirement. We discuss how individuals can be given some discretion over individual contribution and investment levels.

Communication, pension supervision and transition

We illustrate how these conditional pension rights can be communicated in terms of a risk profile of the real income stream in retirement. On the one hand, these schemes share with defined-benefit schemes a focus on the income stream to be provided in retirement. On the other hand, they are similar to individual defined-contribution schemes in that participants are endowed with clear property rights and exhibit transparent exposures to various risks, including investment risks.

The paper discusses the consequences for pension supervision. We investigate the advantages and disadvantages of giving pension funds discretion over their own discount curve and how one can avoid perverse incentives to take more risks in order to raise discount rates and enhance the funding rate. We also explore how model risk can be contained in setting the risk premiums and break-even inflation.

The paper analyses how one can transit from defined-benefit schemes with guaranteed rights to conditional pension rights. We also explore how one can protect individual property rights if pension funds move from one risk profile to another one. In particular, the value of pension rights should stay constant at each horizon.

Preview paper

We attach a very preliminary paper with some results on which we draw (see http://arno.uvt.nl/show.cgi?fid=128354).