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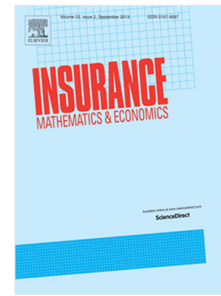
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# Mean-variance target-based optimisation for defined contribution pension schemes in a stochastic framework

Francesco Menoncin\*, Elena Vigna†

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## Abstract

We solve a mean-variance optimisation problem in the accumulation phase of a defined contribution pension scheme. In a general multi-asset financial market with stochastic investment opportunities and stochastic contributions, we provide the general forms for the efficient frontier, the optimal investment strategy, and the ruin probability. We show that the mean-variance approach is equivalent to a “user-friendly” target-based optimisation problem which minimises a quadratic loss function, and provide implementation guidelines for the selection of the target. We show that the ruin probability can be kept under control through the choice of the target level. We find closed-form solutions for the special case of stochastic interest rate following the Vasicek (1977) dynamics, contributions following a geometric Brownian motion, and market consisting of cash, one bond and one stock. Numerical applications report the behaviour over time of optimal strategies and non-negative constrained strategies.

**Keywords:** Mean-variance approach; defined contribution pension scheme; stochastic optimal control; martingale method; efficient frontier; ruin probability.

**JEL:** C61, D81, D90, G11, G22.

## 1 Introduction and motivation

Defined contribution (DC) pension schemes are becoming more and more important in the pension systems of most industrialised countries and are replacing the defined benefit (DB) schemes that were more frequent in the past. It is well known that the investment risk, which is borne by the sponsor in DB pension schemes, is faced by the member in DC pension schemes and its analysis is therefore of the utmost importance nowadays.

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