



# Pricing rate of return guarantees in a Heath–Jarrow–Morton framework

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## Abstract

Rate of return guarantees, included in many financial products, exist in two fundamentally different types. *Maturity guarantees* which are binding only at the expiration of the contract, and therefore, similar to financial options and *multi-period guarantees* which have the time to expiration divided into several subperiods with a binding guarantee for each subperiod. Relevant real-life examples are life insurance contracts and guaranteed investment contracts.

We consider rate of return guarantees where the underlying rate of return is either (i) the rate of return on a stock investment or (ii) the short-term interest rates. Various types of these rate of return guarantees are priced in a general no-arbitrage Heath–Jarrow–Morton framework. We show that despite fundamental differences in the underlying rate of return processes ((i) or (ii)), the resulting pricing formulas for the guarantees are remarkably similar for maturity guarantees. For multi-period guarantees the presence of stochastic interest rates leads to intertemporal dependencies which complicates the valuation formulae compared both to the case of maturity guarantees and the case of deterministic interest rates.

Finally, we show how the term structure models of Vasicek (Vasicek, O., 1977. *Journal of Financial Economics* 5, 177–188) and Cox et al. (Cox, J.C., Ingersoll, Jr., J.E., Ross, S.A., 1985. *Econometrica* 53(2), 385–407) occur as special cases in our more general framework based on the model of Heath et al. (Heath, D., Jarrow, R.A., Morton, A.J., 1992. *Econometrica* 60 (1), 77–105).



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