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“A full Monte Carlo approach to the valuation of the surrender option embedded in life insurance contracts”

ABSTRACT: In this paper we extend the Least Squares Monte Carlo approach (LSM henceforth) proposed by Longstaff and Schwartz (2001) for the valuation of American-style contingent-claims to the case of life insurance contracts. These contracts, in fact, often embed an American-style option, called surrender option, that entitles its owner to early terminate the contract and receive a cash amount, called surrender value. The additional complication arising in life insurance policies with respect to purely financial American contracts is that there is not a fixed date within which the contract can be “exercised”, since the “maturity” is driven by mortality factors. This complication has been handled by very few papers, often at the cost of excessively simplified valuation frameworks (e.g., deterministic interest rates, Geometric Brownian Motion or Binomial Model for the evolution of reference portfolios, deterministic mortality, ...). As is well known, the greatest advantage of the Monte Carlo method is its flexibility, that allows instead to assume more realistic financial frameworks as well as to keep into account the stochasticity of mortality trends. A first attempt to extend the LSM approach to life insurance contracts is due to Andreatta and Corradin (2003), followed by Baione et al. (2004). These papers use indeed a “mixed” approach, in the sense that they merge together the LSM approach with that proposed by Bacinello (2003a, 2003b, 2005) for the valuation of the surrender option and based on multinomial/binomial trees. More in detail, the authors follow the LSM approach only to handle the financial uncertainty, but resort to “analytic” tools for the mortality one. Then the mortality uncertainty is not treated in the same way, and it does not enter either the simulation process or the definition of the (stochastic) discounted cash-flow of the contract. In this paper, instead, the mortality is treated exactly in the same way as the financial one, and it is part of the whole LSM mechanism.