

Chapter 5

Conclusions

Bacinello (2003a) employed CRR model to calculate the fair value of a participating insurance policy. Bacinello assumed a constant risk-free interest rate. The main contribution of this study is to price the participating policy under stochastic interest rate. This work proposes two-dimensional CRR models capable of efficiently pricing the embedded surrender (American-type) option for a long-term policy. Under certain volatility parameter restrictions, a no-arbitrage condition is maintained for the two-dimensional CRR model. The numerical results of two-dimensional CRR models are very close to those of Monte Carlo simulation under the simplified case, $T = 3$. The two-dimensional CRR models can be extended to the participating insurance policies with longer maturity date.

The two-dimensional CRR models have an extremely rapid convergence speed. Zero coupon bond volatility is an essential parameter in the surrender option, and reference portfolio volatilities are important for pricing the participating option. The participating and surrender options are more valuable when the interest rate is trending upwards than when it is constant or trending downwards. Notably, the two-dimensional CRR model and the results it yields can provide suggestions for insurance companies regarding the issue of participating insurance policies.

Future studies are still required regarding two-dimensional CRR models. First, the models can be applied to the periodic-premium case described by Bacinello (2003b). But it is necessary to solve a numerical equation based on an actuarial equivalent principle. Second, two-dimensional CRR models incorporating the relative price of a reference portfolio and a zero coupon bond price are also used for the non-linear volatility assumption, for example the Vasicek model (1977), but these models exclude the the Markovian property of zero coupon bond prices and the recombination of tree structure. However, it encounters the difficulty of time consuming. Finally, the proposed model can also be extended for pricing financial contracts embedding surrender or Bermudan-type options that could be exercised on specified dates.