

Minimizing the risk of a financial product using a put option

GRISELDA DEELSTRA¹, MICHÈLE VANMAELE², AND DAVID VYNCKE²

¹*Department of Mathematics, ECARES, Université Libre de Bruxelles,
CP 210, 1050 Brussels, Belgium*
griselda.deelstra@ulb.ac.be

²*Department of Applied Mathematics and Computer Science, Ghent University,
Krijgslaan 281, S9, 9000 Gent, Belgium*
michele.vanmaele@ugent.be, david.vyncke@ugent.be

ABSTRACT

We elaborate a formula for determining the optimal strike price for a put option, used to hedge a position in a financial product such as an asset or a bond. This strike price is optimal in the sense that it minimizes, for a given budget, a risk measure such as Value-at-Risk or Tail Value-at-Risk. Formulas are derived for one single underlying as well as for a weighted average of underlyings which can also be understood as a portfolio. For the latter we will consider two cases depending on the dependence structure of the components in the weighted sum.

We illustrate our method for an investment in a coupon-bearing bond where the instantaneous-short-rate is modelled by the two-additive-factor Gaussian model G2++ (see [3]).

This paper can be seen as an extension of [1] and [2], who consider the particular problems for an investment in one share, respectively in a bond for which the instantaneous-short-rate model satisfies the assumption to apply the Jamshidian decomposition.

References

- [1] Ahn, D.H., Boudoukh, J., Richardson, M. and Whitelaw, R. *Optimal Risk Management Using Options*, Journal of Finance, 54, pp. 359–375, 1999.
- [2] Annaert, J., Deelstra, G., Heyman, D. and Vanmaele, M. *Risk management of a bond portfolio using options*, Insurance: Mathematics and Economics, 2006 (accepted).
- [3] Brigo, D. and Mercurio, F. *Interest Rate Models — Theory and Practice*, Springer Verlag, Berlin, 2001.