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Volume 10, 2010 - <u>Issue 10</u>

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Research Papers

The risk-shifting effect and the value of a warrant

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Pages 1203-1213 | Received 07 Jan 2008, Accepted 03 Apr 2009, Published online: 08 Oct 2009

L Cite this article **I** https://doi.org/10.1080/14697680902953841



Acknowledgements

The authors gratefully acknowledge the helpful suggestions of Marco Bigelli, Sandro Sandri, Silvia Romagnoli, Fabrizio Palmucci, all members of the Finance Group at the University of Bologna, the Editors, the anonymous referees and the seminar participants at the Association Française de Finance 2007 Bordeaux meeting and Financial Management Association 2008 Prague meeting. All remaining errors are our own responsibility.

Notes

§Similarly, the non-stationary nature of stock volatility due to the presence of debt or warrants was also studied by Geske (<u>1979</u>) and Bensoussan et al. (<u>1994</u>, <u>1995</u>).

†By 'leverage effect' the financial literature refers to a negative correlation between stock prices and volatilities caused by the presence of debt financing (Black <u>1976</u>).



Lintuitively, the net effect on $\epsilon_{\sigma_s,s}^*$ of this substitution is negligible once we recall equation (<u>5</u>). Both of these substitutions (s t for a t and σ_s for σ) produce a downward approximation of the variables, which lowers the product σ_a t but also increases the expression in brackets. As a matter of fact, the above-mentioned approximation determines a drop in N(d ₁) (the warrant's delta) due to the decrease in both moneyness and volatility. Hence, the suggested replacement causes two opposite outcomes, whose net effect tends to be insignificant. The analytical expression of the difference between the two elasticities is provided in <u>appendix A</u>.

†This value is also computable through the numerical algorithm proposed by Ukhov (2004). Nevertheless, in our simulation this method is not necessary since we assume that the asset value and its volatility are both known.

 \pm We obtain a t applying the Newton-Raphson algorithm to the process defined in equation (<u>4</u>).

§We consider a log-normal distribution of asset values. The moneyness bounds are computed according to the following probability intervals: DOTM [0.01, 0.20), OTM [0.20, 0.45), ATM [0.45, 0.55), ITM [0.55, 0.80), and DITM [0.80, 0.99]. First and last percentiles are excluded to avoid an infinite support.

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