Computation of Price Sensitivities

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Typically referred to as *The Greeks*, sensitivities in financial markets are defined as partial derivatives of the price of a contingent claim with respect to the underlying model parameters. To simulate these sensitivities numerically, one usually applies finite difference approximations. Unfortunately, this procedure can become very inefficient, especially when the payoff function is complex or discontinuous.

To by-pass this difficulty, Fournie et al. ([1]) proposed to apply Malliavin calculus to shift the differential operator from the expected payoff function to the underlying diffusion kernel, using integration by parts and introducing a weighting function π:

$$\frac{\partial}{\partial \xi}\mathbb{E}(f(X_t^\xi)) = \mathbb{E}(f(X_t^\xi)\pi),$$

where π is independent of the payoff function f.

The objective of this talk is to extend this approach to jump-diffusion models, by conditioning on the jump times and relying on methods of Malliavin calculus for diffusion processes.

Moreover, we give some explicit examples for the calculation of Greeks and compare simulation results of price sensitivities obtained by finite difference approximations and by Malliavin-Monte Carlo methods.

References

[1] Fournié, E., Lasry, J.M., Lebuchoux, J., Lions, P.-L. and Touzi, N., *Applications of Malliavin calculus to Monte Carlo methods in finance*, Finance Stoch. **3**, No.4, 391-412 (1999).

[2] Forster, B., Lüktebohmert, E. and Teichmann, J., *Calculation of Greeks for Jump-Diffusions*, submitted.