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Perturbed Copula: Introducing the skew effect in the co-dependence

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Gaussian copulas are widely used in the industry to correlate two random variables when there is no prior knowledge about the co-dependence between them. The perturbed Gaussian copula approach allows introducing the skew information of both random variables into the co-dependence structure. The analytical expression of this copula is derived through an asymptotic expansion under the assumption of a common fast mean reverting stochastic volatility factor. This paper applies this new perturbed copula to the valuation of derivative products; in particular FX quanto options to a third currency. A calibration procedure to fit the skew of both underlying securities is presented. The action of the perturbed copula is interpreted compared to the Gaussian copula. A real worked example is carried out comparing both copulas and a local volatility model with constant correlation for varying maturities, correlations and skew configurations.

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