

# The randomised Heston model

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We propose a randomised version of the Heston model—a widely used stochastic volatility model in mathematical finance—assuming that the starting point of the variance process is a random variable. In such a system, we study the small- and large-time behaviours of the implied volatility, and show that the proposed randomisation generates a short-maturity smile much steeper (‘with explosion’) than in the standard Heston model, thereby palliating the deficiency of classical stochastic volatility models in short time. We precisely quantify the speed of explosion of the smile for short maturities in terms of the right tail of the initial distribution, and in particular show that an explosion rate of  $t^\gamma$  ( $\gamma \in [0, 1/2]$ ) for the squared implied volatility—as observed on market data—can be obtained by a suitable choice of randomisation. The proofs are based on large deviations techniques and the theory of regular variations.