

**Rough volatility: SDE driven by Hölder continuous
noise and unbounded drift**

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Having in mind possible stochastic volatility models in finance, we consider an SDE driven by a general Hölder continuous noise. The drift b is exploding with a control from below:

$$b(t, y) > C_T(y - \varphi(t))^{-\gamma} \quad (\gamma > 0),$$

where φ is a continuous function and C_T, γ are constants. We study the solution of such SDE and its properties. In particular, we prove that it has a unique solution which is bound preserving.

Furthermore, modifying the controls on the drift, we obtain an SDE sandwiched between two given bounds φ and ψ , with $\psi(x) > \varphi(x)$. This sandwich solution turns out to be the most useful for applications.

Among the properties presented, we show that the solution admits *all* moments. This remarkable result paves the way for efficient numerical methods.