

## ABSTRACT

Important challenge in long-horizon investments is an appropriate model for interest rates. Actual situation implies a necessity to study a flexible and simplistic model of interest rate, which well accommodates oscillations, cycles, and negative signs. We discuss the dynamical reasons why negative interest rates can happen in the second order differential dynamics and how they can influence the variance and expectation of the process. We consider stochastic interest rate, which generalizes a model Parker (1995), and classify its deterministic part with respect to oscillation and monotonicity, latter according to Kiguradze. We illustrate usefulness of such classification on convenient examples, including feasibility ratio and choice of pension pillar. We also show that 2nd order SDE model allows oscillations and better long term behavior of the interest rate in comparison of 1st order SDE models. Moreover, we introduce a novel nonlinear stochastic interest rate model, which, as a special case, incorporates the standard linear model of Parker. We will point out interesting properties concerning two nonlinear models.

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