

# On a class of semi-elliptic diffusion models. Part I: a constructive analytical approach for global existence, densities, and numerical schemes (with applications to the Libor market model)

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Computational parsimony makes reduced factor Libor market models popular among practioners. However, value functions and sensitivities of such models are described by degenerate parabolic (i.e. semielliptic) equations where the existence of regular global solutions is not trivial. In this paper, we show that for a considerable class of degenerate equations (including equations corresponding to reduced LIBOR market models of practical interest) regular global solutions can be constructed. The result is also of interest for the theory of degenerate parabolic equations. In addition, the constructive proof of the global existence result allows to derive explicit approximations for the transition probabilities. These transition probabilities then lead to sophisticated Monte-Carlo schemes for semielliptic diffusion models (subsuming projective Markovian models). Moreover, recent results on bounded variance estimators for Greeks of valuations under such schemes are generalized to reduced factor models. The emphasis in the present part of our treatment of reduced factor models is on conceptual and (constructive) analytical issues. A more detailed analysis of numerical and computational issues, as well as quantitative experiments will be content of the second part.

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