

A bivariate homogeneous stochastic Vasicek diffusion process

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SUMMARY

In this paper, we extend Vasicek's homogeneous univariate stochastic diffusion process (cf. [4], [1]) to the bivariate case, in the same way as has been described for the bivariate Gompertz and Gamma processes (cf. [2], [3]). We first obtain the analytical expression of the process to resolve the stochastic differential equation that characterises the process in question, its probabilistic distribution and the conditional and unconditional trend functions of the process. Then, using matrix differential calculus, we study the problem of estimating the parameters present in the drift vector and in the diffusion matrix, by maximum likelihood with discrete sampling.

Keywords: Homogenous Vasicek model, Trend functions, Likelihood estimation in diffusion process, Matrix differential calculus.

AMS Classification: 60J60, 62M05

References

- [1] R. GUTIÉRREZ, R. GUTIÉRREZ-SÁNCHEZ, A. NAFIDI AND A. PASCUAL. Detection, modelling and estimation of non-linear trends by using a non-homogeneous Vasicek stochastic diffusion. Application to CO2 emissions in Morocco. *Stoch Environ Res Risk Assess* **26**, 533-543, 2012.
- [2] R. GUTIÉRREZ, R. GUTIÉRREZ-SÁNCHEZ AND A. NAFIDI. A bivariate stochastic Gompertz diffusion model: statistical aspects and application to the joint modeling of the Gross Domestic Product and CO2 emissions in Spain. *Environmetrics* **19**, 643–658, 2008.
- [3] R. GUTIÉRREZ, R. GUTIÉRREZ-SÁNCHEZ AND A. NAFIDI. A bivariate stochastic Gamma diffusion model: statistical inference. *Monografías matemáticas Graciá de Galdeano* **36**, 79–88, 2010.
- [4] O. A. VASICEK . An equilibrium characterization of the term structure. *J Finan Econ* **5**, 177–188, 1977.

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