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CLIMATE MODELS AND COMMODITY PRICING WITH STOCHASTIC PROCESSES ADAPTED BY NEURAL NETWORKS EXHIBITING POSSIBLE TRANSITIONS TO CHAOS

Stefan Giebel[1], Martin Rainer[2]

[1]University of Luxembourg, Luxembourg
[2]Institute of Applied Mathematics, Middle East Technical University, Ankara, Turkey
[2]ENAMEC Institute, Würzburg, Germany

[1]*stefan.giebel@gmx.de*, [2]*martin.rainer@enamec.de*

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Abstract

Local climate parameters may naturally effect the price of many commodities and their derivatives. Therefore we propose a joint framework for stochastic modeling of climate and commodity prices. In our setting certain basic martingales are drift augmented to an SDE defined by a nonlinear function on the state space, which may exhibit deterministic chaos. Additionally, a neural network adapts the parameters of the process such that the latter produces increasingly optimal differences between simulated output and observed data. Thus we propose a novel method of "intelligent" calibration of the stochastic process, using learning neural networks in order to dynamically adapt the parameters of the stochastic model. The optimal network function is also applied for prediction, using dynamical data splits. The deterministic part by itself is investigated for chaotic instability, as revealed in particular by the Lyapunov exponent.