ICRAMCS 2026

THE EIGHTHEDITION OF THE INTERNATIONAL CONFERENCE ON RESEARCH IN APPLIED MATHEMATICS AND COMPUTER SCIENCE
April23-24-25, 2026 | Marrakech, Morocco

Modeling of Morocco's GNI per capita using the 1/2-power stochastic Lundqvist-Korf model

Communication Info

Authors:
Abdenbi EL AZRI[1,2]
Ahmed NAFIDI[2]

[1]Higher Institute of Nursing Professions and Health Techniques of Casablanca, Casablanca, Morocco
[2]Hassan First University of Settat, National School of Applied Sciences, Laboratory of Systems Modelization and Analysis for Decision Support, Berrechid, Morocco

Keywords:
(1) Stochastic modeling
(2) Parameter estimation techniques
(3) Statistical analysis
(4) GNI forecasting

Abstract

In this study, we develop a new non-homogeneous stochastic diffusion model based on the 1/2-power Lundqvist-Korf formulation to forecast Morocco's gross national income (GNI) per capita [1,4]. Using a mathematical transformation and Itô's calculus, we derive key probabilistic properties of the model, including its analytical solution. We also establish the transition probability density function and compute the corresponding mean functions [3]. Parameter estimation is carried out using the maximum likelihood method applied to discretely sampled data. Given the complexity of the resulting equations, we adopt the simulated annealing algorithm to perform the estimation [2,5]. The methodology is first validated using simulated data, followed by an application to real-world GNI per capita data from Morocco.

References

[1] A. El Azri, A. Nafidi, A stochastic diffusion process based on the Lundqvist-Korf growth: Computational aspects and simulation, Mathematics and Computers in Simulation, 182, 2021, 25--38.

[2] S. Kirkpatrick, C. D. Gelatt, M. P. Vecchi, Optimization by simulated annealing, Science, 220(4598), 1983, 671--680.

[3] P. Kloeden, E. Platen, The numerical solution of stochastic differential equations, Springer Berlin, Germany, 1992.

[4] A. Nafidi, A. El Azri, R.G. Sánchez, The stochastic modified Lundqvist-Korf diffusion process: Statistical and computational aspects and application to modeling of the CO2 emission in Morocco, Stochastic Environmental Research and Risk Assessment, 36, 2022, 1163--1176..

[5] P. Romàn-Romàn, D. Romero, M.A. Rubio, F. Torres-Ruiz, Estimating the parameters of a Gompertz-type diffusion process by means of Simulated Annealing, Applied Mathematics and Computation, 218, 2012, 5121--5131.