# Project D

# Option Calibration and Pricing (HJM NIG)

You are asked to calibrate an HJM model on French electricity swaps and price structured pay-offs options by means of Monte Carlo simulation.

The DATA_FREEX file contains all liquid maturities for the French power futures and the options prices (implied volatility quotes) on the 2026 and the 2028 futures on the 4th of November 2024.

i. Consider an HJM model for the 2026 French power swap driven by a normal inverse Gaussian process (i.e. 6.9 in Benth 2008 with p=0 and n=1). Consider a constant $Y(t, T_1, T_2)$ (the coefficient in the stochastic integral). What is the admissible range for the model parameters?

ii. You should ensure that forward prices are martingales. Can you write explicitly the condition on the drift (i.e. without using numerical integration)?

iii. Calibrate the model on the 2026 French option prices (the entire surface) by minimizing the distance between model and market prices. Comment on the quality of the calibration. Can you improve it in some way?

iv. Price an option that pays at time t=1 $\left(\max_{t\in(0,1)} F(t, T_1, T_2) - K\right)^+$; where $T_1$ is the 1st of January of 2026, T2 is the 31st of December 2026 and K is 300. Does an explicit formula exist?

v. Calibrate the model on the 2026 and 2028 option prices at the same time consider again a constant $Y(t, T_1, T_2)$. Comment on the quality of the calibration.

vi. [Facultative] With the model at point v. price an option that pays at time t=1 $(\max(F(1, T_1, T_2), F(1, T_3, T_4)) - K)^+$; where $T_3$ is the 1st of January of 2028, $T_4$ is the 31st of December 2028. Does an explicit formula exist, or do you need to use a Monte Carlo method?

Deliver a MATLAB library.