

Données et Statistiques en Finance : modèles d'agents : TP4

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20 mai 2022

Aims

1. To implement Franke & Westerhoff's model.
2. To explore the behaviour of this model.
3. To calibrate this model.

1. Implement Franke and Westerhoff model

- Write a function that accepts parameters and that returns the vector r_t .
- Note : you must impose $|x_t| \leq 1$ in the code

2. Explore FW model's behaviour

What empirical facts does this model reproduce?

1. For $\phi = 0.18$, $\chi = 2.35$, $\mu = 0.01$, $\nu = 2.57$, $\alpha_0 = -0.15$, $\alpha_x = 1.35$, $\alpha_d = 11.4$, $\sigma_f = 0.79$, $\sigma_c = 1.91$, and at least 10000 iterations, plot r_t as a function of t . Comment.
2. Plot $P(|r| > R)$.
3. Using powerlaw package, estimate the tail exponent c of $P(|r| > R) \propto R^{-c+1}$. Comment.
4. Vary ϕ , χ , α_0 (independently) in order to understand how c depends on these parameters. Does the value of c uniquely determine the model parameter set?

3. Calibrate this model

- Download the `rt.csv.gz` file which contains the output of a simulation of F-W model with unknown parameters ϕ, χ, α_0 .
- 1. Exploration : plot $P(r > R)$ (from the file) and estimate its tail exposant. Comment.
- 2. Let us denote by c_{file} the above exponent and c_{model} the one produced by a model with a given parameter set. One writes the cost function

$$K = (c_{\text{file}} - c_{\text{model}})^2.$$

Find the parameter set that minimises K with

- 2.1 `scikit.optimize.minimize`. Note : if a parameter must be positive (say), do make it explicitly positive in the code of FW model. Otherwise, weird effects may occur. Example : replace $a > 0$ with b^2 in the model definition.
Why does a straightforward optimization fail to be of much help?
- 2.2 By *tâtonnement* (trial and error, manually). Use your understanding of how c depends on the parameters from question 2.

3. Calibrate II

3. Run at least 20 times F-W model with the parameter set that you think minimises K . For each run, estimate c_{run} and compute the average and standard deviation over all the runs.

1. is the average over these runs close to c_{file} ?
2. is the uncertainty on the average c over the runs large? What can you conclude