Examen cours de finance statistique

Janvier 2024

No document allowed, 3 heures

- (2 pts) Give the CAPM equations for expectation and variance of returns, providing accurate definitions of all quantities. What does the CAPM tell us about the relationship between risk and returns in finance? How can you prove the validity of CAPM in practice? (give main mathematical elements without entering in details)
- (2 pts) Consider you have access to interest rates curve between 2000 and 2023, one curve every month, with 10 maturity points for each curve, from 1 year to 10 years. Describe how you would analyze the results of a PCA applied to this dataframe and what you expect to see.
- (2 pts) Consider two one-dimensional Ito processes X and Y driven by two correlated Brownian motions W and B with constant correlation ρ and (stochastic) volatilities σ_t^X and σ_t^Y. We observe X and Y over $[0,1]$ at times i/n, $i = 0, \cdots, n$ with $n \geq 0$. Give an estimator of the parameter ρ and provide a sketch of proof of its consistency as n goes to infinity.
- (2 pts) How would you demonstrate that rough volatility models are superior to conventional stochastic volatility models? (1 page maximum, several answers are possible)
- (2 pts) Using Hawkes processes, explain the connection between market microstructure, market impact and rough volatility (1 page maximum).
- (10 pts) Summarize (quickly) and comment the enclosed article in light of what has been seen in class. Discuss the obtained results, the strengths and weaknesses of the approach, the relevant points and the limitations. Suggest way to improve this work or interesting directions to extend it.