Thesis Goal

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Empirical data have shown that the volatility behaviour is rough. The aim of our thesis is to investigate the pricing of financial claims using a convex combination of stochastic and rough volatility models. The combination will be chosen in a data-driven way using a Bayesian framework. Our work will be divided into two parts:

1. **direct problem:** given calibrated models and the convex combinations we want to price path-dependent financial claims. Goals for this part will be:
    - delve into the theory of already existent numerical schemes for integration of SDE;
    - analyze their numerical stability and other numerical properties if required;
    - implement them in a, possibly, efficient way.
2. **inverse problem:** calibrate the models to actual market-data using puts & calls prices and, given a Bayesian framework and the payoff of the claim that we want to price, find a convex combination to weight the prices of the models. Goals for this part will be:
    - delve into the theory of rough models calibration;
    - implement the calibration of the models;
    - delve into the theory of hierarchical Bayesian modelling;
    - fix our Bayesian framework and estimate the coefficients for the convex combination;
    - look into the posterior parameters densities to assess how confident we are in our predictions and also to look into the robustness of the models.