

December 3

CFinance

Cologne Computational Finance Laboratory

## Computational Finance 2 - 8th Assignment

Deadline: December 10

Exercise 18 (GARCH(1,1))

The GARCH(1,1) model is given by

$$\sigma_k^2 = \omega + \alpha u_{k-1}^2 + \beta \sigma_{k-1}^2, \quad \omega = \gamma V_L \tag{1}$$

a) Denote by V the square of the volatility of the asset price. Show that (1) is equivalent to the stochastic volatility model

$$dV = a(V_L - V)dt + \xi V dW,$$

where time is measured in days;  $a = 1 - \alpha - \beta$ ,  $V_L = \frac{\omega}{1 - \alpha - \beta}$ , and  $\xi = \alpha \sqrt{2}$ .

b) Assuming that time is measured in years, put down the stochastic volatility model.

## Exercise 19 (Barles-Soner model)

The differential equation of Barles and Soner is:

$$\frac{df(x)}{dx} = \frac{f(x) + 1}{2\sqrt{xf(x)} - x} \text{ with } f(0) = 0.$$

- a) By numerical computations, analyze the solution for  $-2 \le x \le 2$ .
- b) Construct in a piecewise fashion an approximating function  $\widehat{f}(x)$ .

## **Information:**

Deadline for Programming Assignment (Exercise 19): December, 17

(10 Points)

(20 Points)