Monte Carlo-GARCH method to VaR calculation on high percentiles

# INTRODUCTION

This work calculates the 1 day 99.97% Value at Risk using a Monte Carlo/GARCH(1.1).

We use the IBM time series from 01.01.2016 till 01.01.2016 as input for the GARCH(1,1) model calibration.

# Modeling the volatility:

We use in this work the time series of IBM from the period 2000-2016. The total number of samples available during this periods is approximately 250 days/year x 16 years. This amount of daily data contributes with 12 samples when computing a 99.97% VaR with 1 day horizon.

Using IBM time series of returns, computing the 99.97% 1day VaR, we obtain a value of 5.065%.

Instead of using the historical VaR, we are going to model the daily volatility using a GARCH(1,1). Once the volatility is modelled, we will run a Monte Carlo simulation to compute a numerical VaR.

## GARCH:

The equations used to model our return series are:

Where,

is the return at time t

is a standard Normal distribution

is the conditional daily volatility

In our case we have used a GARCH(1,1) to model the daily volatility of the IBM time series, in the following picture is shown the volatility TO BE DONE.

## Monte Carlo

The simulation is carried using as follows:

1. Generate a sample from a Standard Normal Distribution
2. Compute the conditional volatility as follows:
3. Compute the return
4. Repeat the process till the number of samples is filled in.

We use this simple Monte Carlo process to generate the necessary number of samples to be used when computing the VaR at 99.97% confidence level.

If we use this algorithm to generate sample. Our VaR calculation will have 300 samples available.

