Introduction to Financial Risk Management (with R)

Exercise 7 – Estimating Expected Shortfall (ES) of the Normal Distribution

Overview

The goal of this exercise is to use R to estimate expected shortfall (ES) of the normal distribution, using the two estimated parameters: mean and standard deviations, for the daily log returns of Gold.

Estimating the VaR for daily log returns of the Wilshire 5000 index

In the lectures, we ran the following R script to create a data series called “wilsh”:

```
library(quantmod)
getSymbols("WILL5000IND",src="FRED")
wilsh <- na.omit(WILL5000IND)
wilsh <- wilsh["1979-12-31/2017-12-31"]
names(wilsh) <- "TR"
```

Next, we calculated its daily log returns:

```
logret <- diff(log(wilsh))[-1]
```

Assuming that daily log returns are normally distributed, we used the following R commands to estimate the two parameters of the normal distribution: mean and standard deviation.

```
mu <- mean(logret)
sig <- sd(logret)
```

The ES at the 95% confidence level for the daily log returns can be calculated using the estimated mean (mu) and estimated standard deviation (sig):

```
es <- mu-sig*dnorm(qnorm(0.05,0,1),0,1)/0.05
```

In the lecture, we used an example of a hedge fund investing $1000 million in US equities. We can now find the ES of the daily change in its assets, at the 95% confidence level, using the following R command:

```
HFvar <- 1000 * ( exp(es)-1 )        # in millions of dollars
```

Estimating the ES for daily log returns of Gold

In Exercise 2, you retrieved the price of gold in the London Bullion Market at 3pm from FRED: “GOLDPMGBD228NLBM”

In Exercise 5, you estimated its mean and standard deviation for the sample from 1979-12-31 to 2017-12-31

In this exercise, you will use the estimated mean (mu) and estimated standard deviation (sig) to find the ES at the 95% confidence level.