

Oppgave 4

GARCH

Pakker

```
In[1]:= << "BarCharts` "; << "Histograms` "; << "PieCharts` "
```

Valgte parametre

```
In[2]:= T = 5000;  
zGBM = Table[Random[NormalDistribution[0, 1]], {i, T}];  
zGARCH = Table[Random[NormalDistribution[0, 1]], {i, T}];  
 $\mu$  = 0.0;  
 $\sigma$  = Table[0, {i, T}];  
logAvkastningerGARCH = Table[0, {i, T}];  
 $\theta_0$  = 0.000002;  
 $\theta_1$  = 0.09;  
 $\theta_2$  = 0.89;  
k = 3;
```

Volatilitet

```

In[12]:=  $\sigma[[1]] = k \sqrt{\frac{\theta_0}{1 - (\theta_1 + \theta_2)}} ;$ 

forventetVolatilitet [t_] :=  $\sqrt{\frac{\theta_0 (1 - (\theta_1 + \theta_2)^t)}{1 - (\theta_1 + \theta_2)} + (\theta_1 + \theta_2)^t \sigma[[1]]^2} ;$ 

Print["Startvolatiliteten er ",  $\sigma[[1]]$ ,

      " pr dag og den langsiktige forventningen til volatiliteten er ",  $\sqrt{\frac{\theta_0}{1 - (\theta_1 + \theta_2)}}$  ];

```

Startvolatiliteten er 0.03 pr dag og den langsiktige forventningen til volatiliteten er 0.01

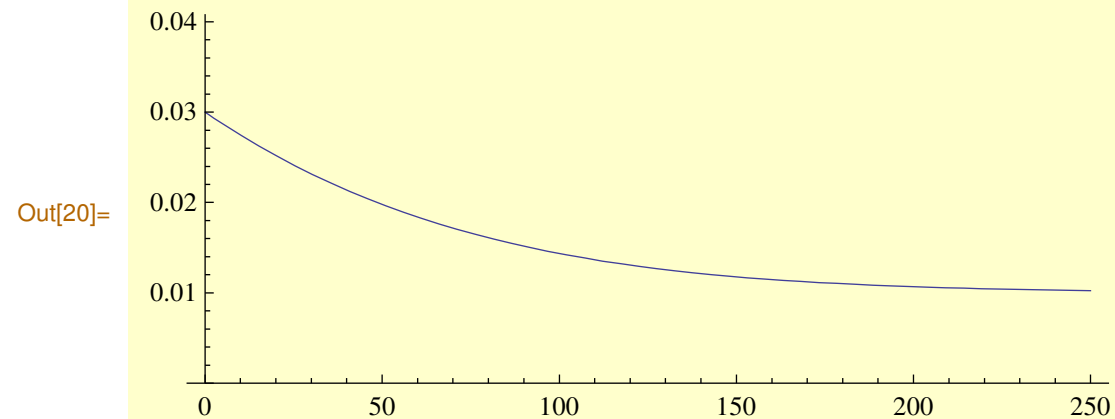
log avkastninger

```
In[15]:= logAvkastninger =  $\mu + \sqrt{\frac{\theta_0}{1 - (\theta_1 + \theta_2)}} z_{GBM}$ ;
logAvkastningerGARCH [[1]] =  $\mu + z_{GARCH} [[1]] \sigma [[1]]$ ;
For [i = 2, i ≤ T,
  ( $\sigma [[i]] = \sqrt{(\theta_0 + \theta_1 (z_{GARCH} [[i - 1]] \sigma [[i - 1]])^2 + \theta_2 \sigma [[i - 1]]^2}$ ); logAvkastningerGARCH [[i]] =  $\mu + z_{GARCH} [[i]] \sigma [[i]]$ ); i++
];

In[18]:= range = {Min [logAvkastningerGARCH ], Max [logAvkastningerGARCH ]};
```

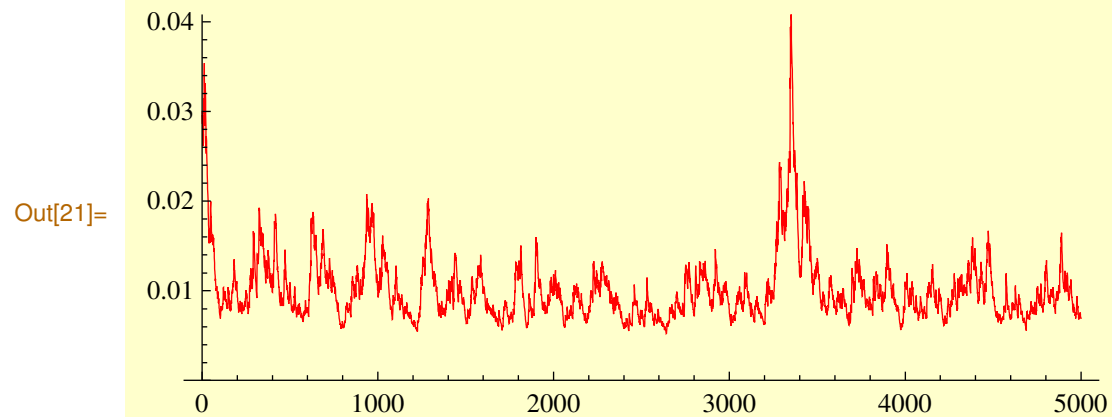
Forventet volatilitet med GARCH(1,1)

In[20]:= `Plot[forventetVolatilitet[t], {t, 0, 250}, PlotRange -> {0, Max[σ]}, AspectRatio -> .4]`



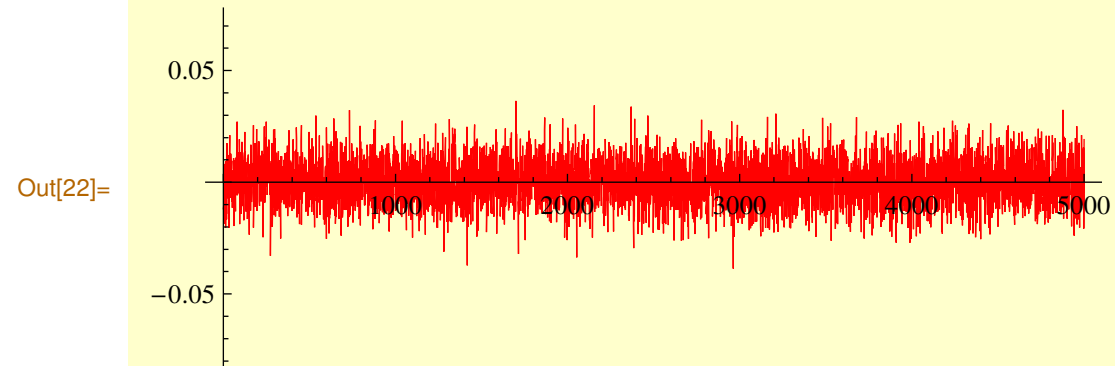
Realisert volatilitet med GARCH(1,1)

```
In[21]:= ListPlot[ $\sigma$ , Joined  $\rightarrow$  True, AxesOrigin  $\rightarrow$  {0, 0}, PlotRange  $\rightarrow$  {0, Max[ $\sigma$ ]}, PlotStyle  $\rightarrow$  RGBColor[1, 0, 0], Aspect
```



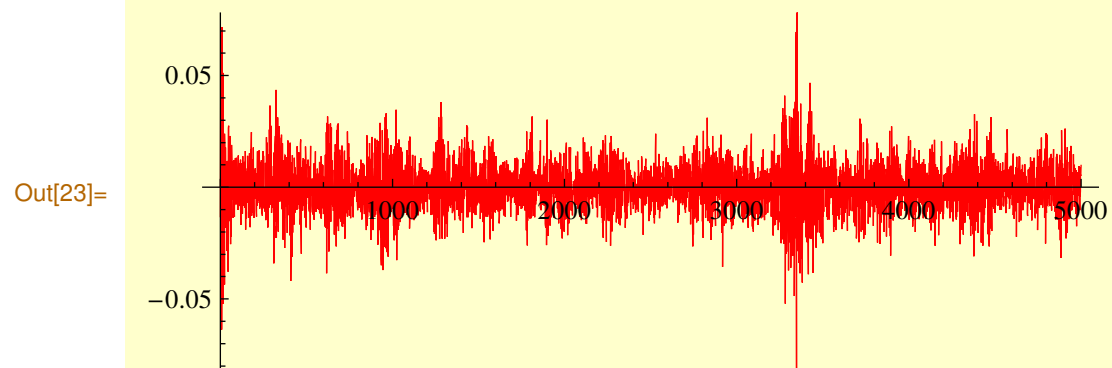
log avkastninger med konstant volatilitet

```
In[22]:= ListPlot[logAvkastninger, Joined → True, AxesOrigin → {0, 0},  
PlotRange → range, PlotStyle → RGBColor[1, 0, 0], AspectRatio → .4]
```



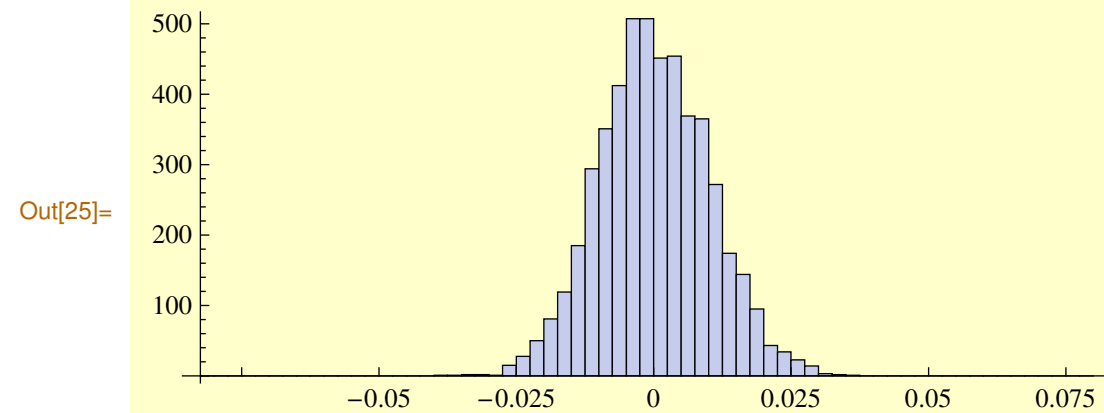
log avkastninger med GARCH(1,1)

```
In[23]:= ListPlot[logAvkastningerGARCH, Joined → True, AxesOrigin → {0, 0},  
PlotRange → range, PlotStyle → RGBColor[1, 0, 0], AspectRatio → .4]
```



log avkastninger med konstant volatilitet

In[25]:= `Histogram[logAvkastninger, HistogramRange -> range, AspectRatio -> .4]`



log avkastninger med GARCH(1,1)

In[26]:= `Histogram[logAvkastningerGARCH, HistogramRange -> range, AspectRatio -> .4]`

