

The background of the slide is a light gray gradient. It is decorated with numerous realistic water droplets of various sizes. Some droplets are large and prominent, while others are small and subtle. They are scattered across the slide, with a higher concentration in the top-left and bottom-right corners. Each droplet has a soft highlight and a gentle shadow, giving them a three-dimensional appearance.

Homework 4

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```
#install.packages('rjson', repos='http://cran.us.r-project.org')
library('rjson')
json_file = 'http://crix.hu-berlin.de/data/crix.json'
json_data = fromJSON(file=json_file)
crix_data_frame = as.data.frame(json_data)
n<-dim(crix_data_frame)
a<-seq(1,n[2],2)
b<-seq(2,n[2],2)
date<-t(crix_data_frame[1,a])
price<-t(crix_data_frame[1,b])
```

```
ts.plot(price)
ret<-diff(log(price))
plot(ret)
ts.plot(ret)
```

```
# histogram of returns
```

```
hist(ret, col = 'black', breaks = 20, freq = FALSE, ylim = c(0, 25), xlab = NA)
```


```
lines(density(ret), lwd = 2)
```

```
mu = mean(ret)
```

```
sigma = sd(ret)
```

```
x = seq(-4, 4, length = 100)
```


```
curve(dnorm(x, mean = mean(ret), sd = sd(ret)), add = TRUE, col = 'blue', lwd = 2)
```




```
# qq-plot  
qqnorm(ret)  
qqline(ret, col = 'grey', lwd = 3)
```

```
# acf plot  
autocorr = acf(ret, lag.max = 20, ylab = 'Sample Autocorrelation', main = NA, lwd = 2,  
ylim = c(-0.3, 1))
```

```
# plot of pacf  
autopcorr = pacf(ret, lag.max = 20, ylab = 'Sample Partial Autocorrelation', main = NA,  
ylim = c(-0.3, 0.3), lwd = 2)
```






```
# select p and q order of arima model  
fit4 = arima(ret, order = c(2, 0, 3))  
tsdiag(fit4)  
Box.test(fit4$residuals, lag = 1)
```

```
fitr4 = arima(ret, order = c(2, 1, 3))  
tsdiag(fitr4)  
Box.test(fitr4$residuals, lag = 1)
```

```
# to conclude, 202 is better than 213  
fit202 = arima(ret, order = c(2, 0, 2))  
tsdiag(fit202)  
tsdiag(fit4)  
tsdiag(fitr4)
```



```
# arima202 predict
```

```
fit202 = arima(ret, order = c(2, 0, 2))
```

```
crpre = predict(fit202, n.ahead = 30)
```

```
dates = seq(as.Date('02/08/2014', format = '%d/%m/%Y'), by = 'days', length =  
length(ret))
```

```
plot(ret, type = 'l', xlim = c(0, 644), ylab = 'log return', xlab = 'days', lwd = 1.5)
```

```
lines(crpre$pred, col = 'green', lwd = 3)
```

```
lines(crpre$pred + 2 * crpre$se, col = 'green', lty = 3, lwd = 3)
```

```
lines(crpre$pred - 2 * crpre$se, col = 'green', lty = 3, lwd = 3)
```