Unit 4

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# HW 4-1
code

```r
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)
#plot of time series#
par(mfrow=c(3,2))
crix_data_frame_t<-t(crix_data_frame)
time<-crix_data_frame_t[seq(1,2350,by=2)]
price<-as.numeric(crix_data_frame_t[seq(2,2350,by=2)])
crix_data_frame<-cbind(time,price)
time_series<-ts(data=price, start =c(2015,7,31), frequency = 365)
plot(time_series,main="The time series of price")
#plot of return#
ret<-diff(log(price))
plot(ts(ret,start= c(2015,7,31),frequency = 365),main="The time series of ret")
#histogram of price and ret#
hist(price,breaks=50,col = "red",freq = FALSE,xlab="price",main = "Histogram of
price")
lines(density(price),col="black",lwd=2)

hist(ret,breaks = 40,col = "blue",freq = FALSE,main = "Histogram of price")
lines(density(ret),col="black",lwd=2)

x=seq(-4,4,length=100)
curve(dnorm(x,mean=mean(ret),sd=sd(ret)),add=TRUE,col="red",lwd=2)
#normal qq plot#
qqnorm(ret)
qqline(ret,col="blue",lwd=3)
```
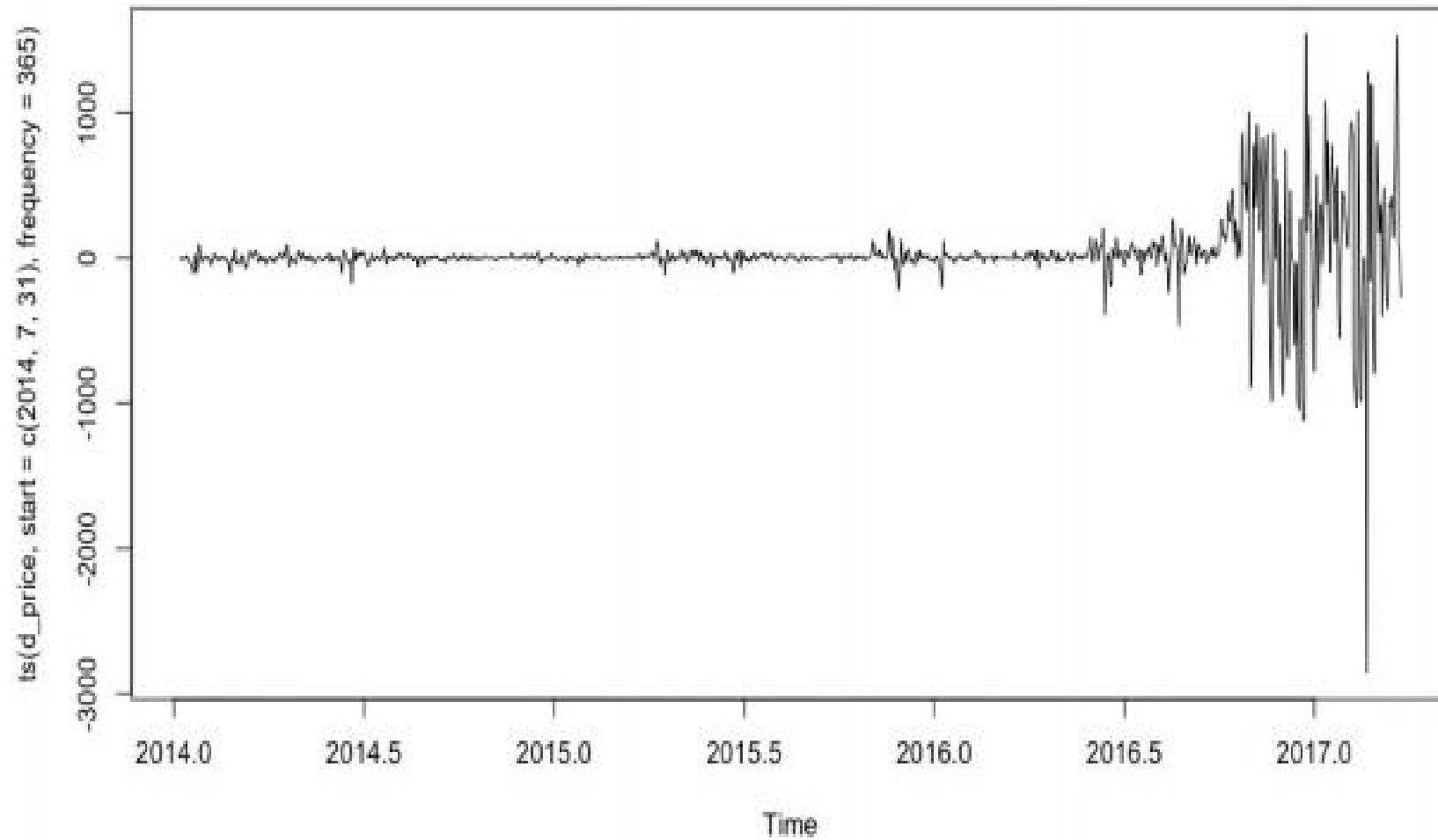
Result

The time series of price

The time series of ret

Histogram of price

Histogram of price

Normal Q-Q Plot
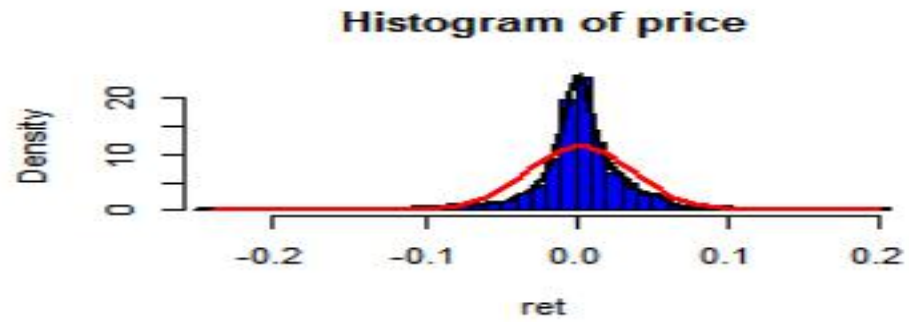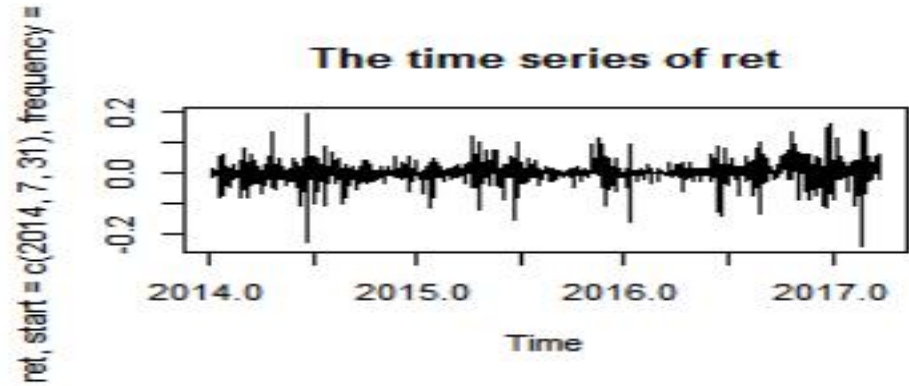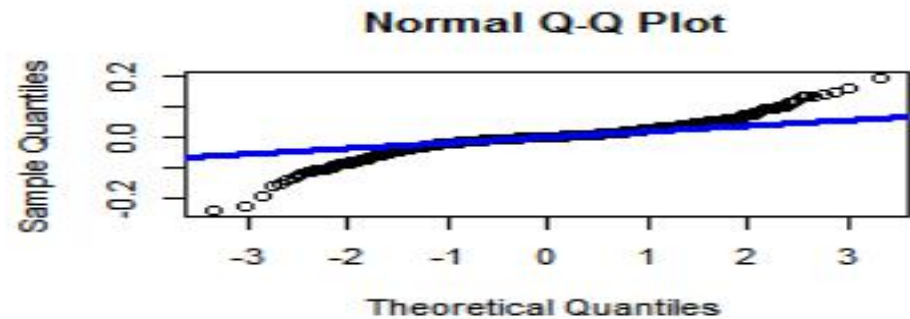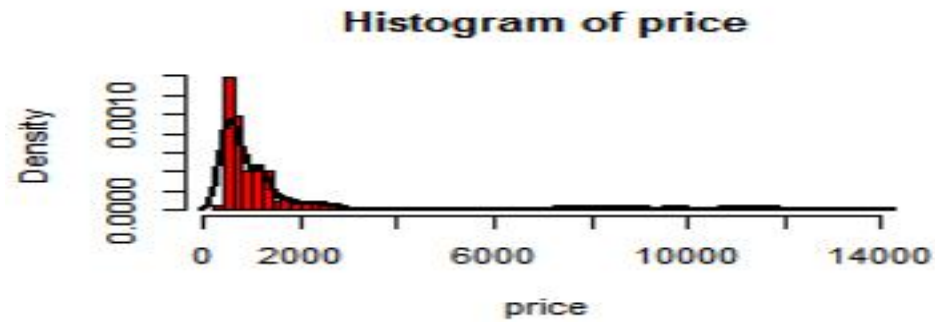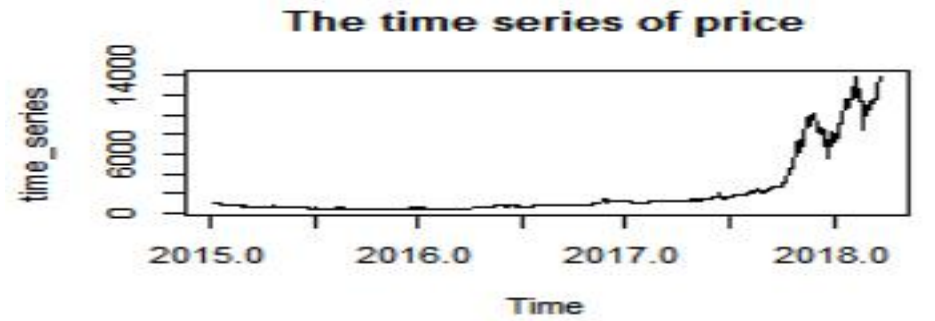
HW 4-2 andHW 4-3

code

```
library(forecast)
library(tseries)
#stationary test#
ndiffs(price)
par(mfrow=c(1,1))
d_price<-diff(price,lag=2)
plot(ts(d_price,start =c(2015,7,31),frequency = 365))
adf.test(d_price)
#ACF and PACF#
par(mfrow=c(2,2))
Acf(price)
Pacf(price)
Acf(d_price)
Pacf(d_price)
#fit model#
fit<-arima(time_series,order = c(0,2,3))
fit
accuracy(fit)
#model test#
par(mfrow=c(1,1))
qqnorm(fit$residuals)
qqline(fit$residuals)
Box.test(fit$residuals,type = "Ljung-Box")
#model forecast#
forecast(fit,5)
plot(forecast(fit,5),xlab = "time",ylab = "price")
```
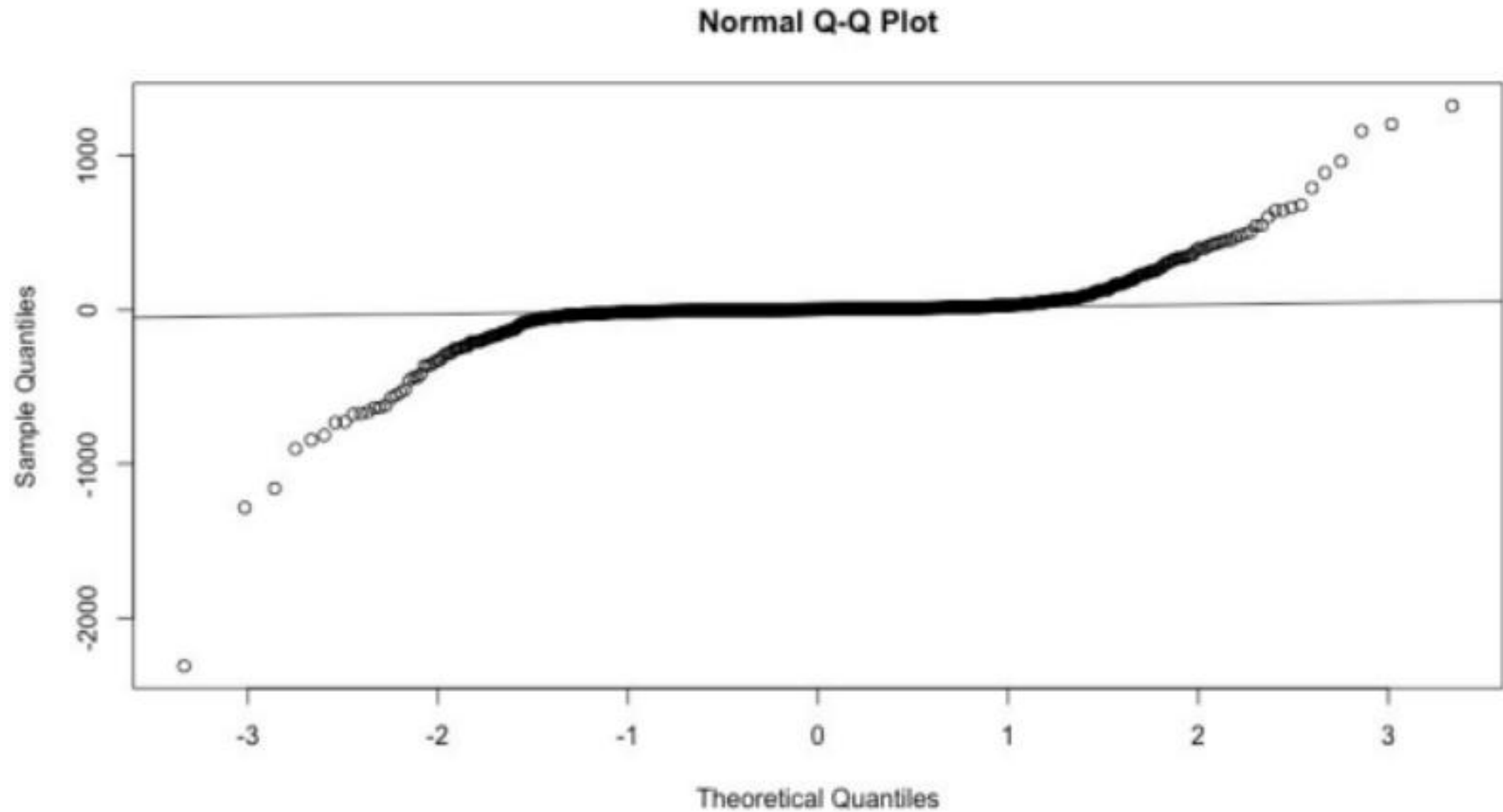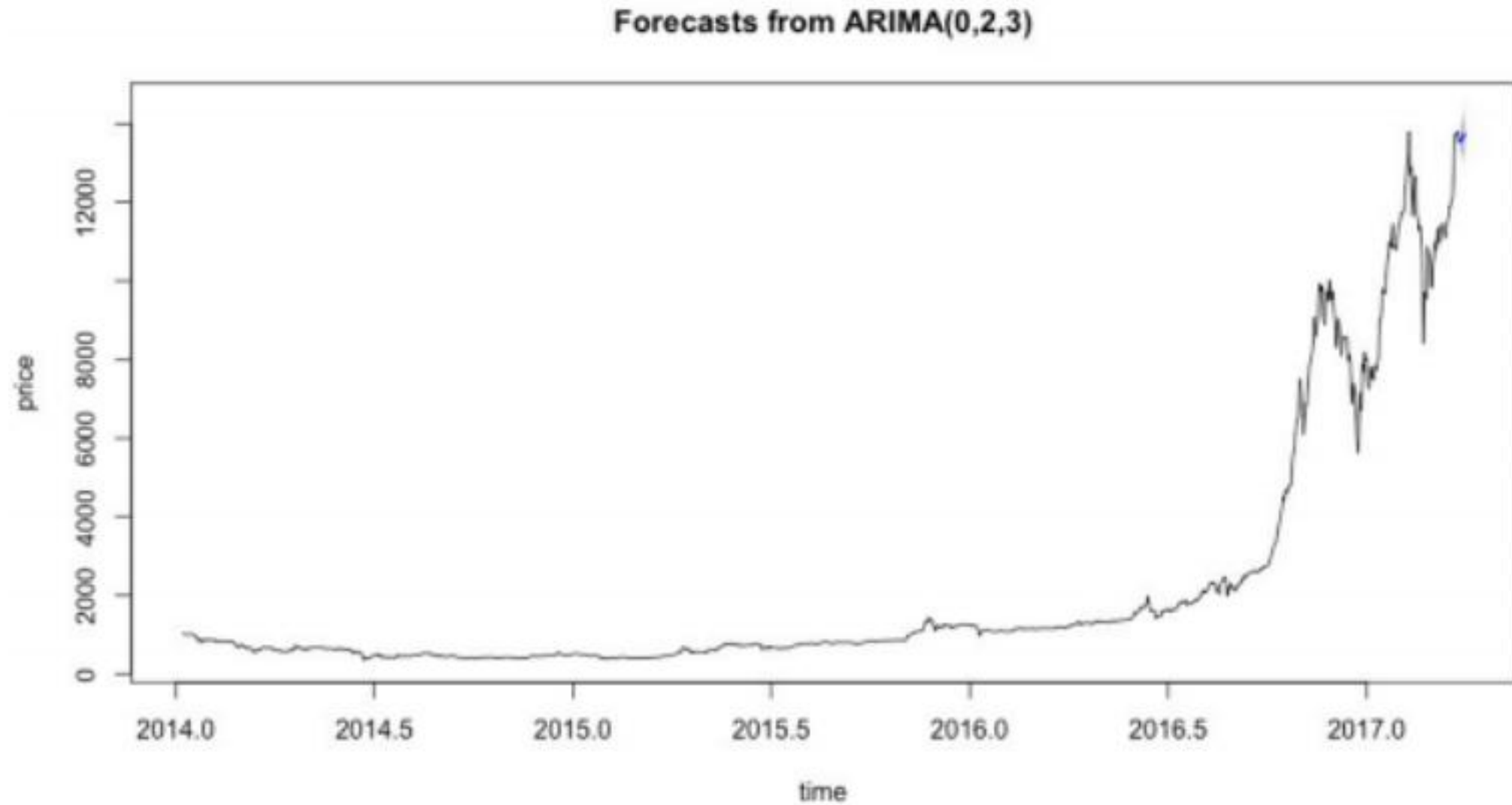
Result

Result

Result

Normal Q-Q Plot

Result

Forecasts from ARIMA(0,2,3)
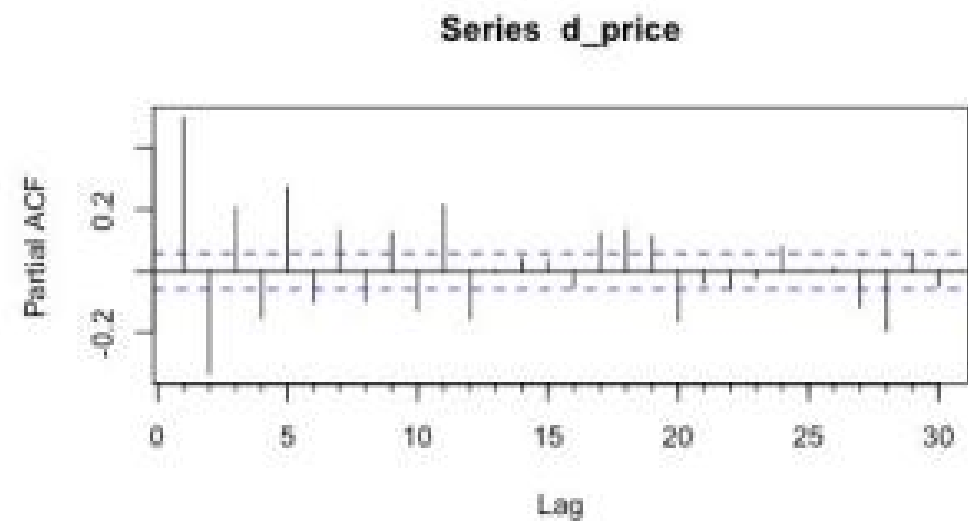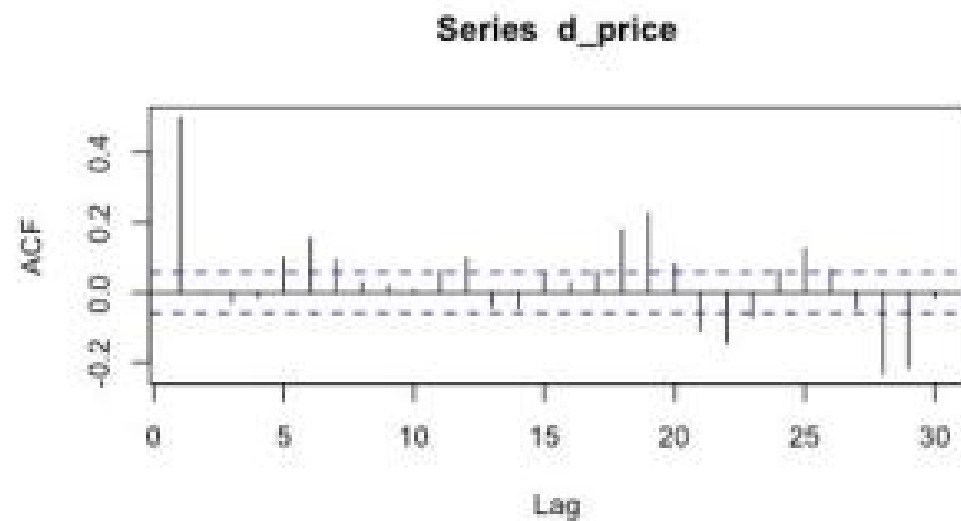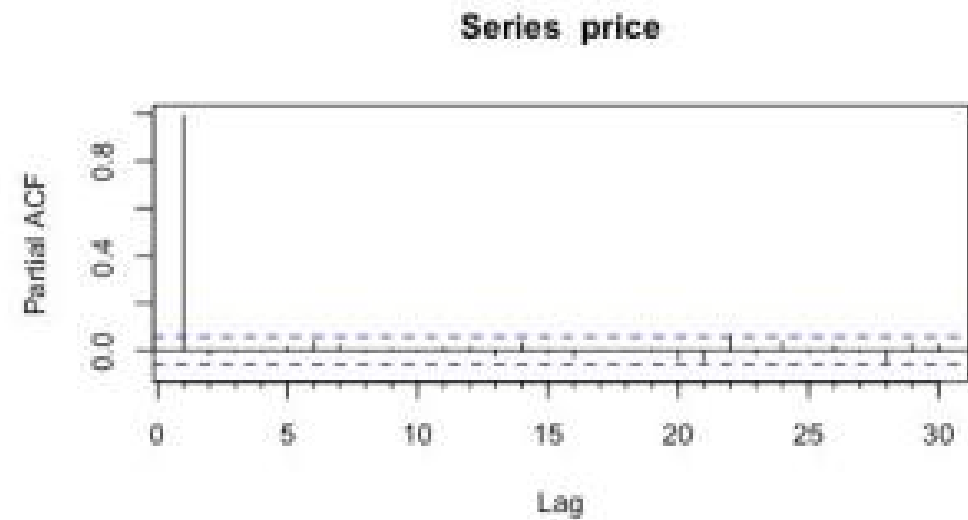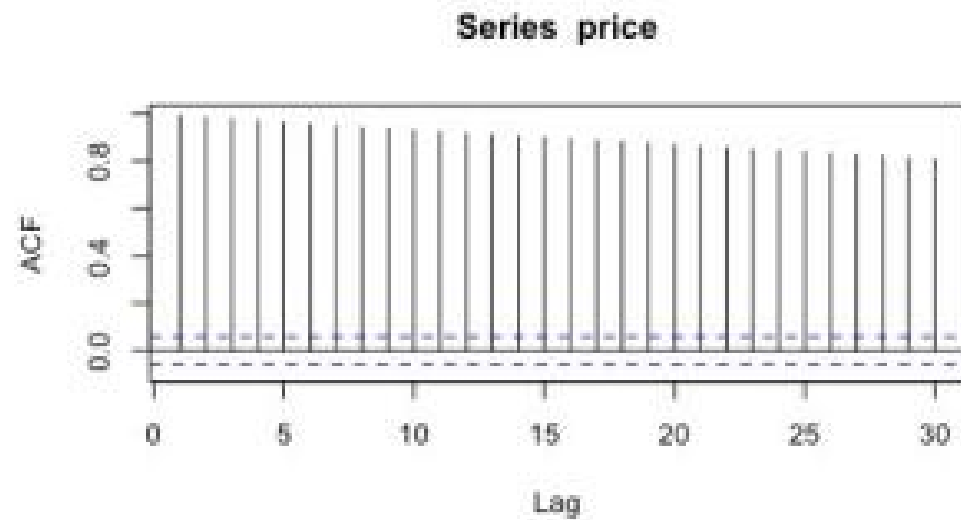
Result

```
Call:
arima(x = time_series, order = c(0, 2, 3))

Coefficients:
         ma1      ma2      ma3
      -1.0186   0.0286  -0.0033
s.e.   0.0293   0.0417   0.0308

sigma^2 estimated as 29389:  log likelihood = -7700.73,  aic = 15409.45
> accuracy(fit)
                    ME      RMSE      MAE       MPE      MAPE      MASE        ACF1
Training set  5.963777  171.2866  61.05574  0.1945169  2.177519  0.9829255  -0.002283453
```

	Point Forecast	Lo 80	Hi 80	Lo 95	Hi 95
2017.2356	13559.25	13339.55	13778.95	13223.25	13895.25
2017.2384	13601.01	13293.19	13908.83	13130.24	14071.78
2017.2411	13643.86	13266.78	14020.94	13067.16	14220.55
2017.2438	13686.71	13250.52	14122.90	13019.62	14353.80
2017.2466	13729.56	13240.71	14218.40	12981.93	14477.18