

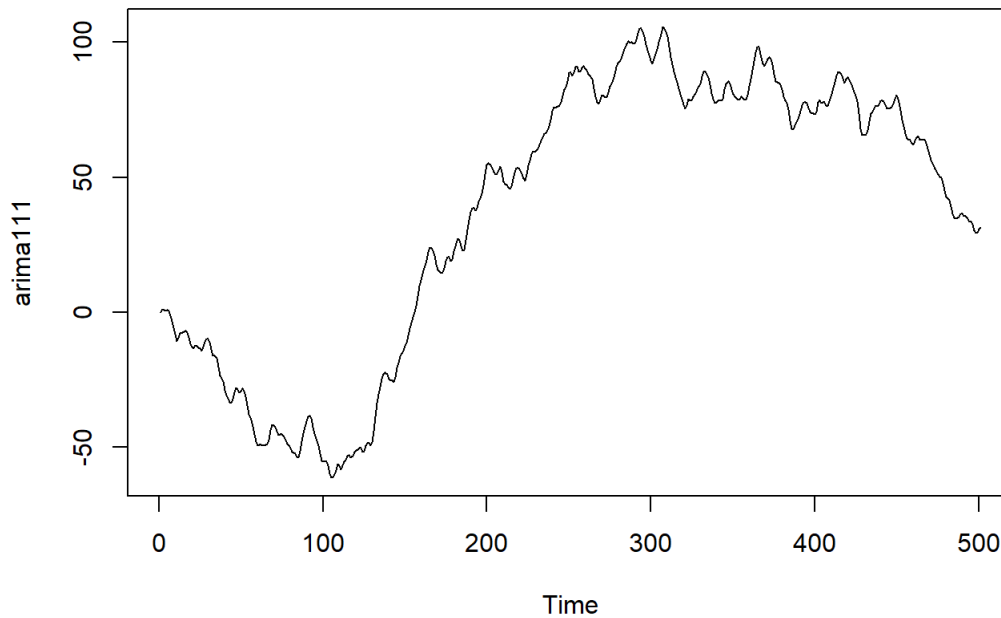
ARIMA

arima/sarima arima() !

```
arima(x, order=c(p,d,q),seasonal = list(order=c(P,D,Q), period = 12))
```

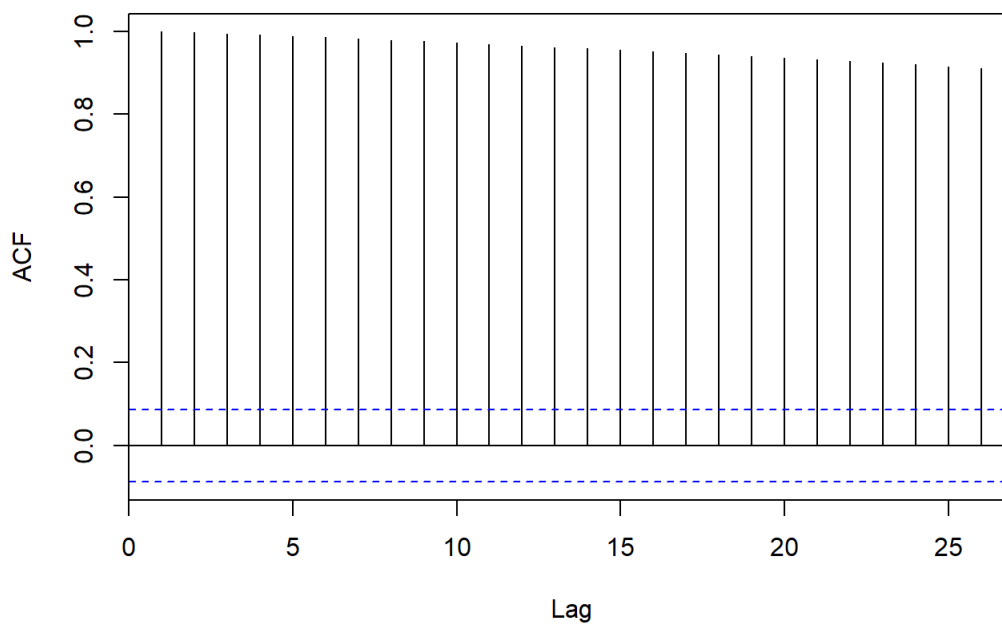
```
arima111 = arima.sim(model = list(order = c(1, 1, 1), ar = 0.5, ma = .7),n=500)  
plot(arima111,main = 'ARIMA(1,1,1)')
```

ARIMA(1,1,1)

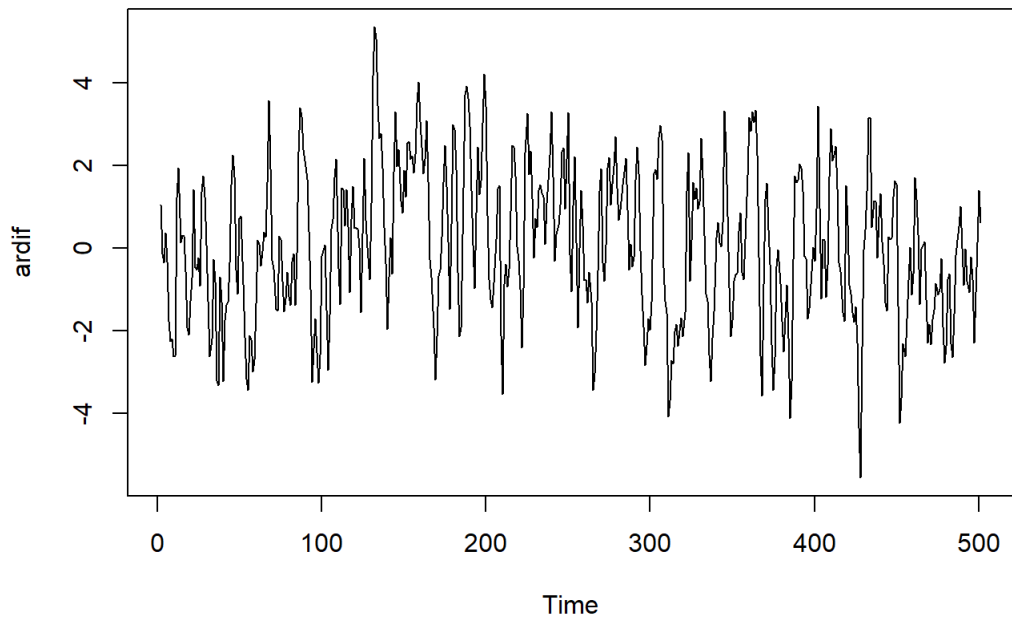


```
acf(arima111,main="Acf of ARIMA(1,1,1)")
```

Acf of ARIMA(1,1,1)

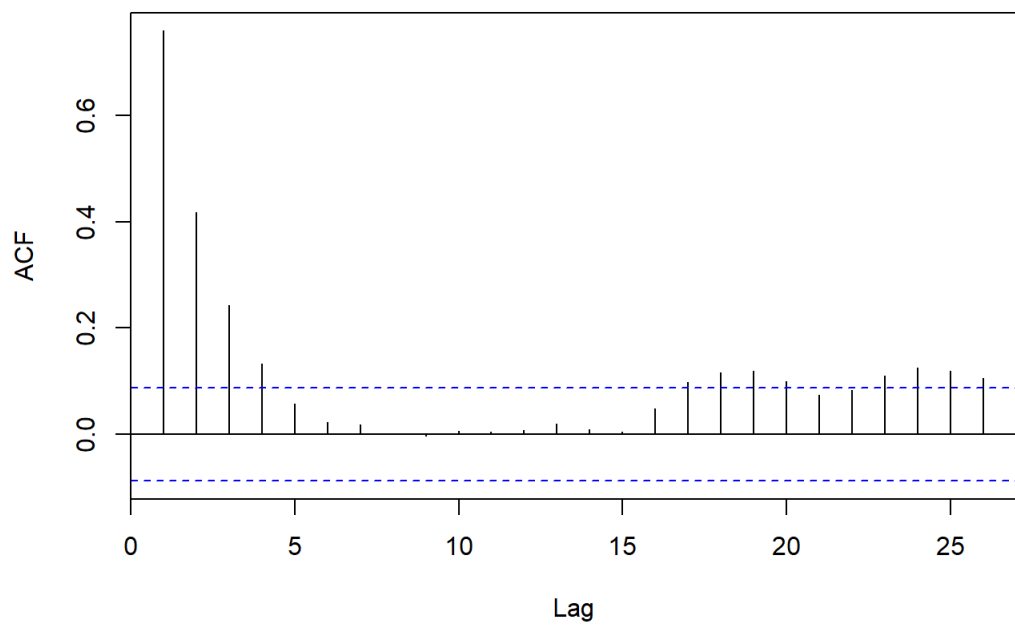


```
ardif = diff(arima111)  
plot(ardif)
```



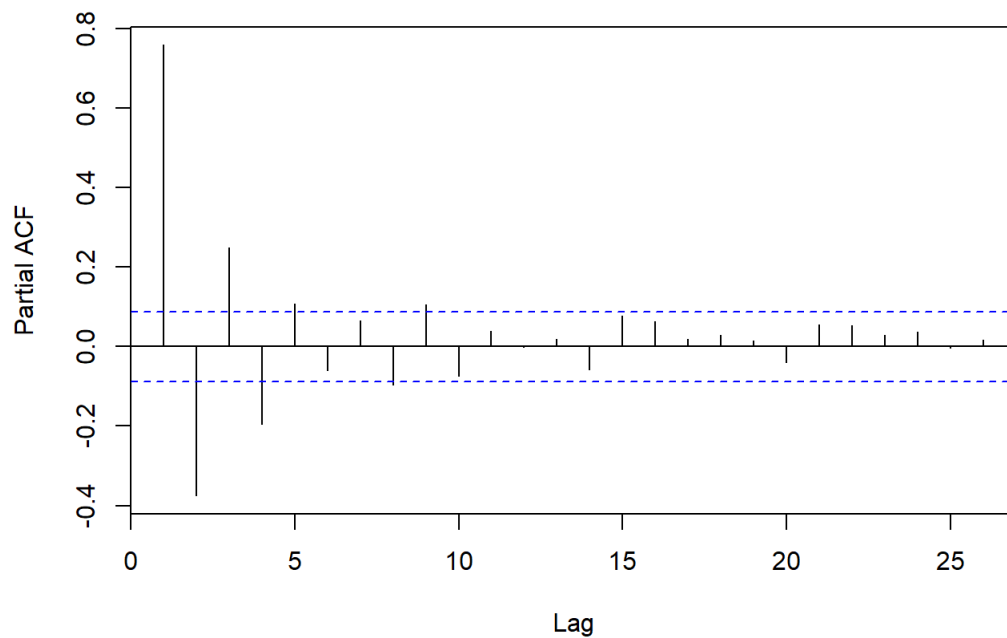
```
acf(ardif)
```

Series ardif



```
pacf(ardif)
```

Series ardif

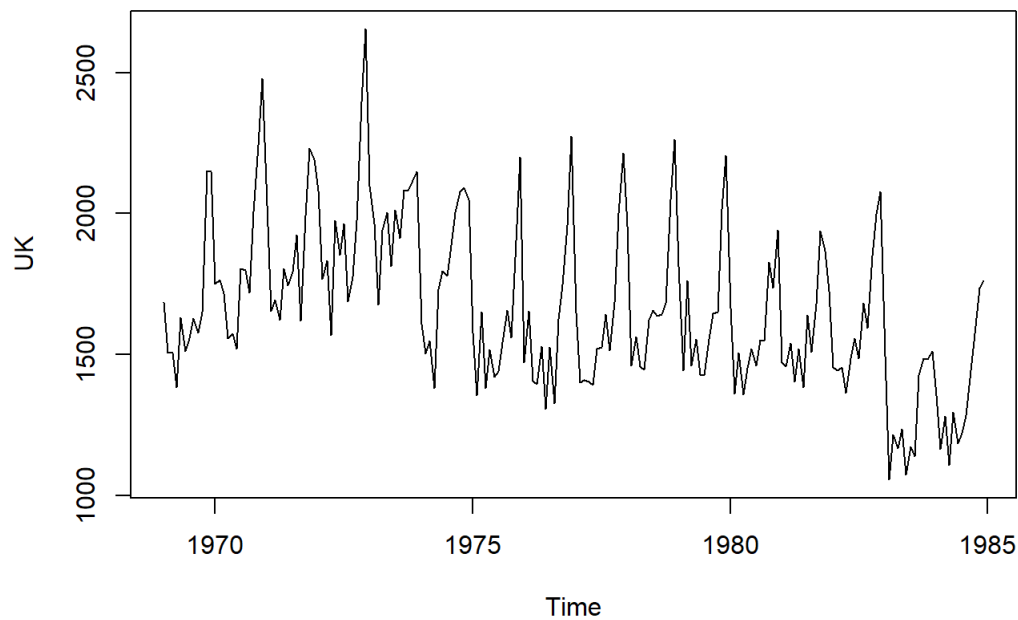


```
auto.arima(ardif)
```

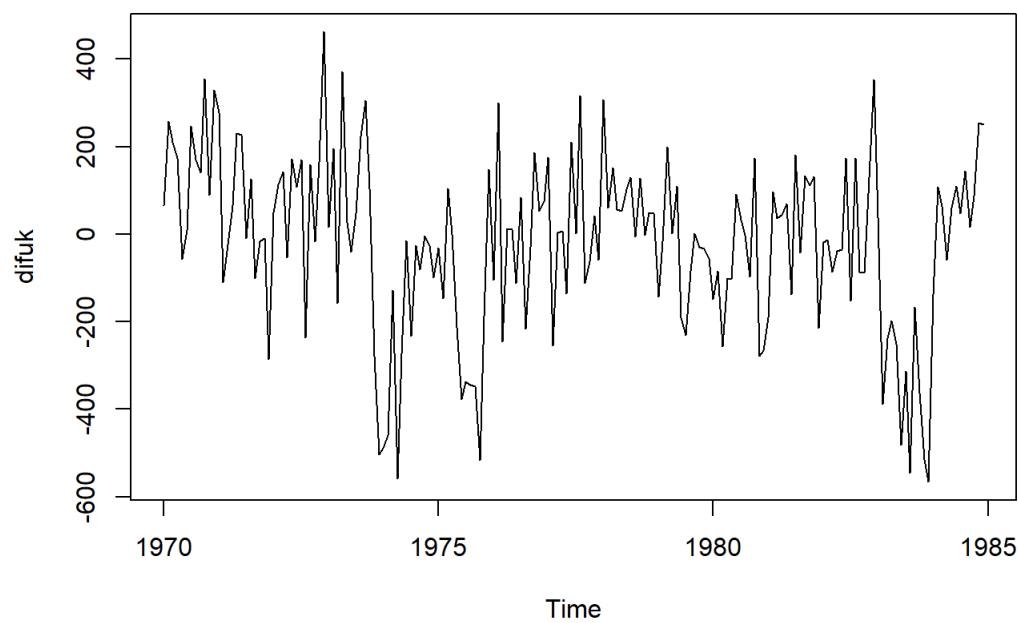
```
## Series: ardif
## ARIMA(1,1,2)
##
## Coefficients:
##      ar1   ma1   ma2
##  0.4686 -0.199 -0.7662
## s.e. 0.0471 0.039 0.0365
##
## sigma^2 estimated as 1.051: log likelihood=-720.22
## AIC=1448.45  AICc=1448.53  BIC=1465.3
```

SARIMA

```
UK = UKDriverDeaths
plot(UK)
```



```
difuk = diff(UK,lag = 12)  
  
plot(difuk)
```



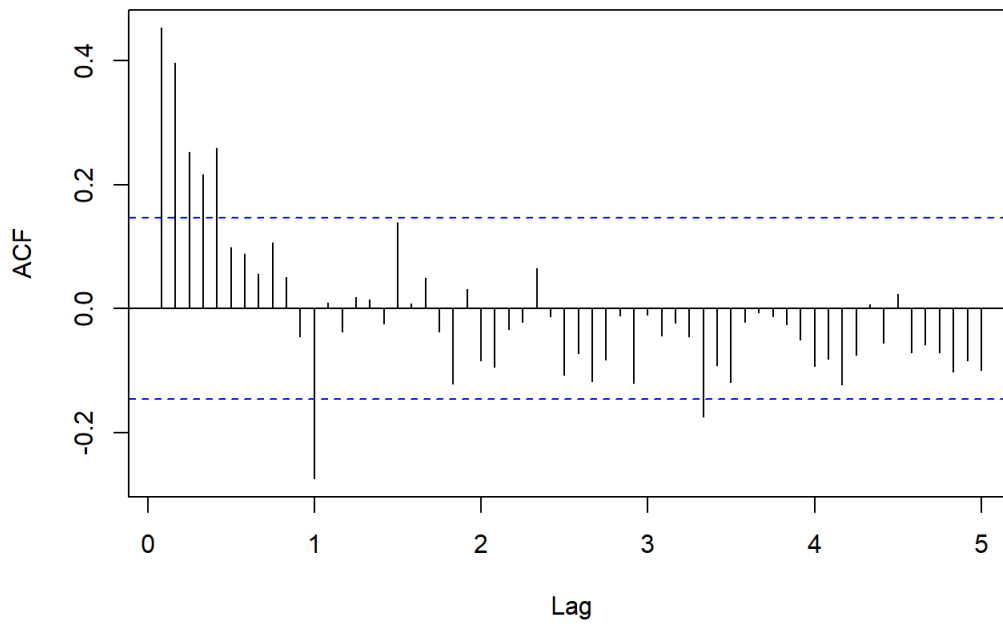
```
kpss.test(difuk)
```

```
## Warning in kpss.test(difuk): p-value greater than printed p-value
```

```
##  
## KPSS Test for Level Stationarity  
##  
## data: difuk  
## KPSS Level = 0.3247, Truncation lag parameter = 4, p-value = 0.1
```

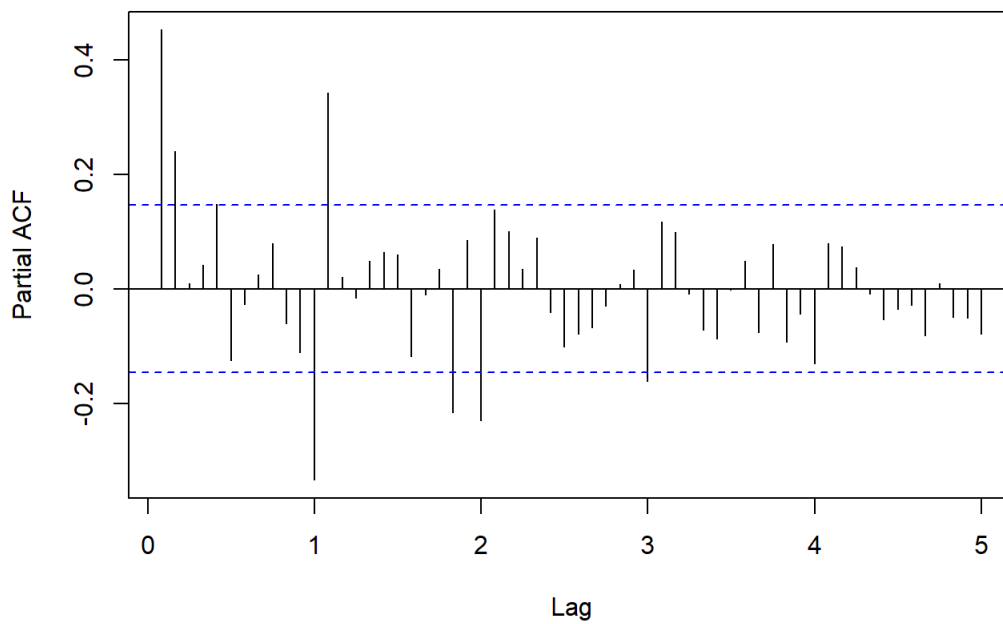
```
acf(difuk,lag.max = 60)
```

Series difuk



```
pacf(difuk, lag.max = 60)
```

Series difuk



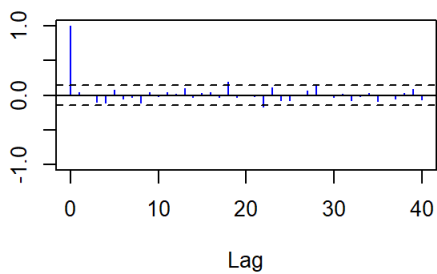
```
auto.arima(UK)
```

```
## Series: UK
## ARIMA(1,0,1)(0,1,1)[12]
##
## Coefficients:
##      ar1    ma1    sma1
##  0.9546 -0.5561 -0.8723
## s.e. 0.0354 0.0950 0.0799
##
## sigma^2 estimated as 18242: log likelihood=-1145.39
## AIC=2298.78  AICc=2299.01  BIC=2311.55
```

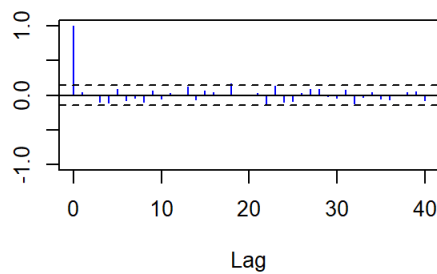
```
fit <- auto.arima(UK)
test(residuals(fit))
```

```
## Null hypothesis: Residuals are iid noise.
## Test      Distribution Statistic  p-value
## Ljung-Box Q      Q ~ chisq(20)   19.8  0.4703
## McLeod-Li Q      Q ~ chisq(20)   24.79 0.2095
## Turning points T (T-126.7)/5.8 ~ N(0,1) 120 0.2516
## Diff signs S      (S-95.5)/4 ~ N(0,1) 88 0.0615
## Rank P          (P-9168)/445.1 ~ N(0,1) 8566 0.1762
```

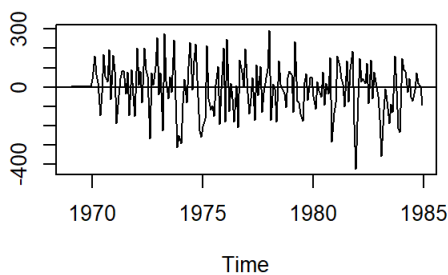
ACF



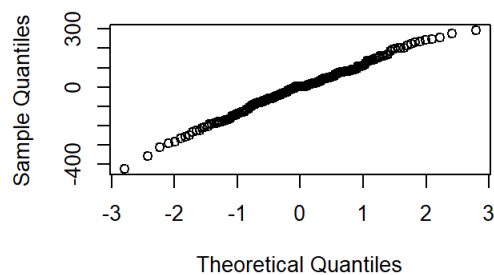
PACF



Residuals

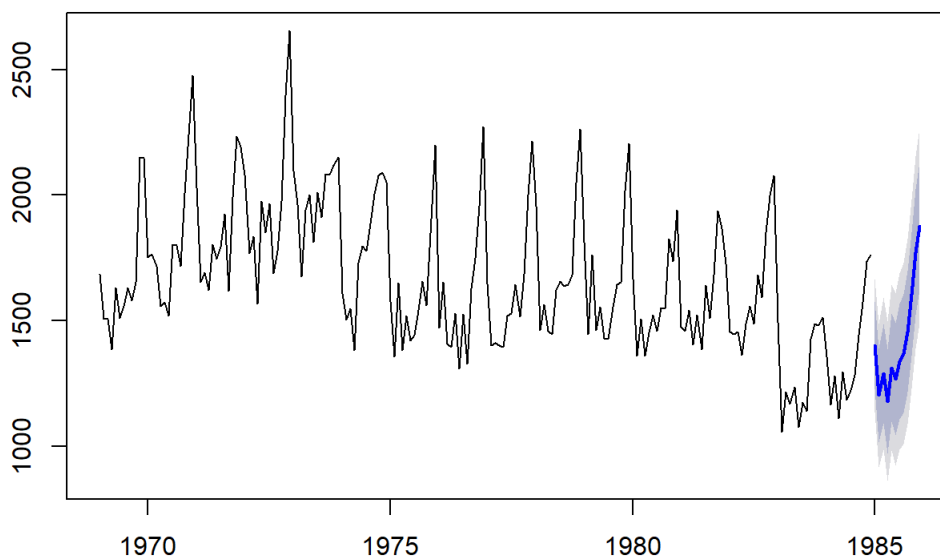


Normal Q-Q Plot



```
plot(forecast(fit,h=12))
```

Forecasts from ARIMA(1,0,1)(0,1,1)[12]



```
#arfima
sun = sunspots
arfima(sun)
```

```
##
## Call:
## arfima(y = sun)
##
## Coefficients:
##      d  ar.ar1  ma.ma1  ma.ma2
## 0.24676848 0.97439271 0.64294637 0.08996052
## sigma[eps] = 15.70645
## a list with components:
## [1] "log.likelihood" "n"      "msg"      "d"
## [5] "ar"             "ma"       "covariance.dpq" "fnormMin"
## [9] "sigma"          "stderror.dpq" "correlation.dpq" "h"
## [13] "d.tol"          "M"         "hessian.dpq"    "length.w"
## [17] "residuals"      "fitted"     "call"          "x"
## [21] "series"
```

ARCH/GARCH

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