

Chapter 45: Arima Models

Section 45.1: Modeling an AR1 Process with Arima

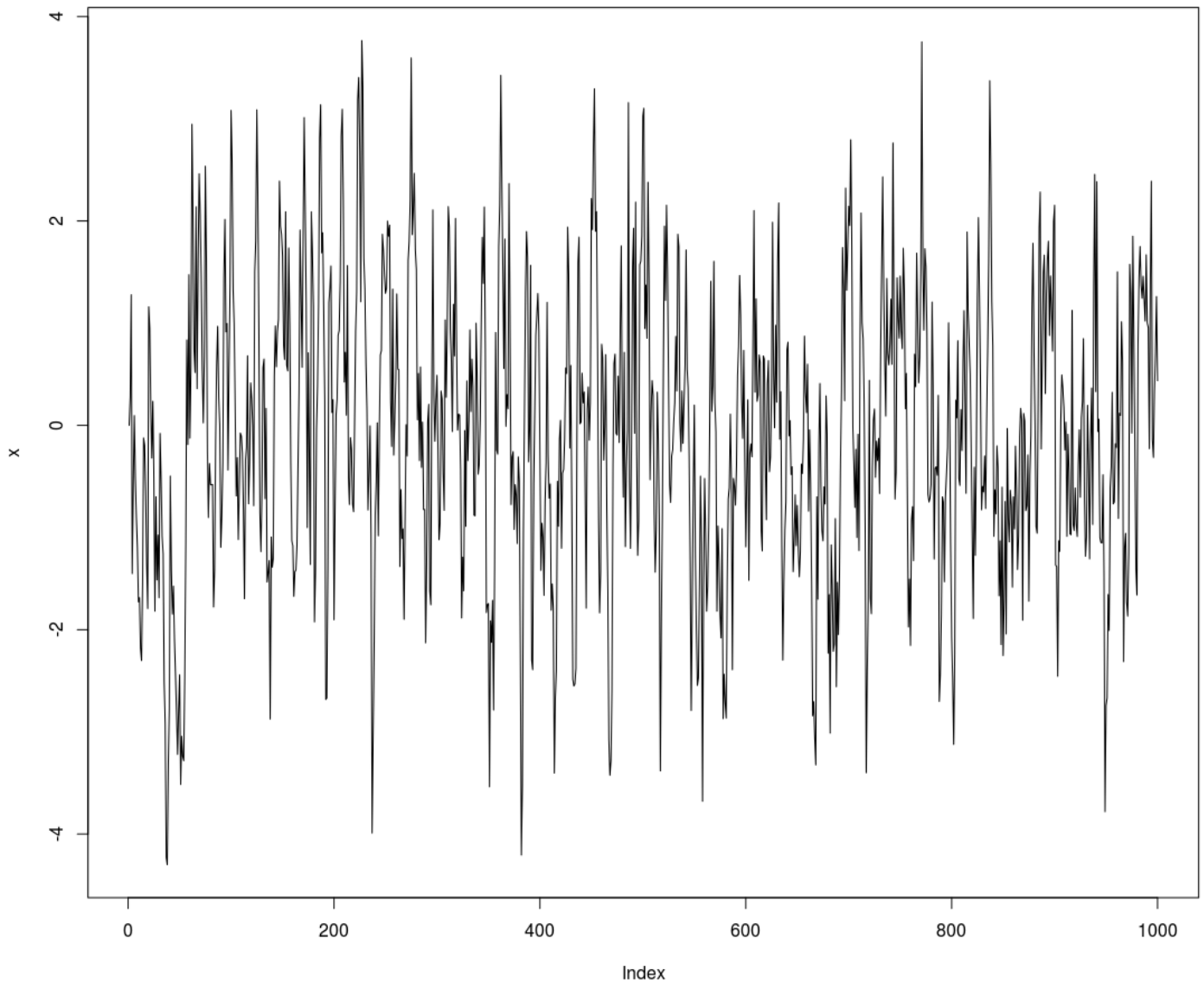
We will model the process

$$x_t = .7x_{t-1} + \epsilon \quad \epsilon \sim N(0, 1)$$

```
#Load the forecast package
library(forecast)

#Generate an AR1 process of length n (from Cowpertwait & Meltcalfe)
# Set up variables
set.seed(1234)
n <- 1000
x <- matrix(0, 1000, 1)
w <- rnorm(n)

# loop to create x
for (t in 2:n) x[t] <- 0.7 * x[t-1] + w[t]
plot(x, type='l')
```



We will fit an Arima model with autoregressive order 1, 0 degrees of differencing, and an MA order of 0.

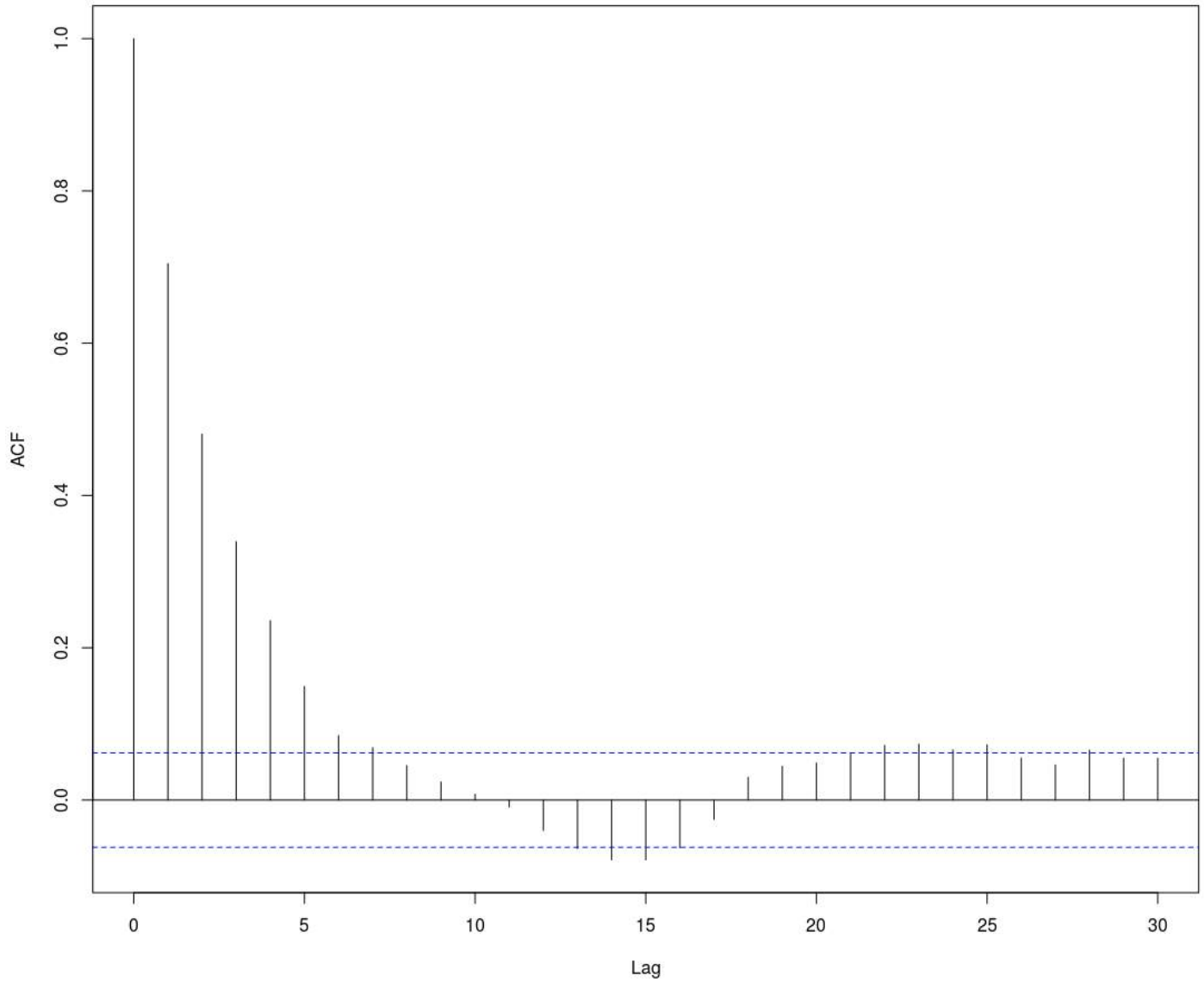
```
#Fit an AR1 model using Arima
fit <- Arima(x, order = c(1, 0, 0))
summary(fit)
# Series: x
# ARIMA(1,0,0) with non-zero mean
#
# Coefficients:
#      ar1  intercept
#      0.7040   -0.0842
# s.e.  0.0224    0.1062
#
# sigma^2 estimated as 0.9923:  log likelihood=-1415.39
# AIC=2836.79  AICc=2836.81  BIC=2851.51
#
# Training set error measures:
#              ME      RMSE      MAE  MPE  MAPE      MASE      ACF1
# Training set -8.369365e-05 0.9961194 0.7835914 Inf  Inf 0.91488 0.02263595
# Verify that the model captured the true AR parameter
```

Notice that our coefficient is close to the true value from the generated data

```
fit$coef[1]
#      ar1
# 0.7040085
```

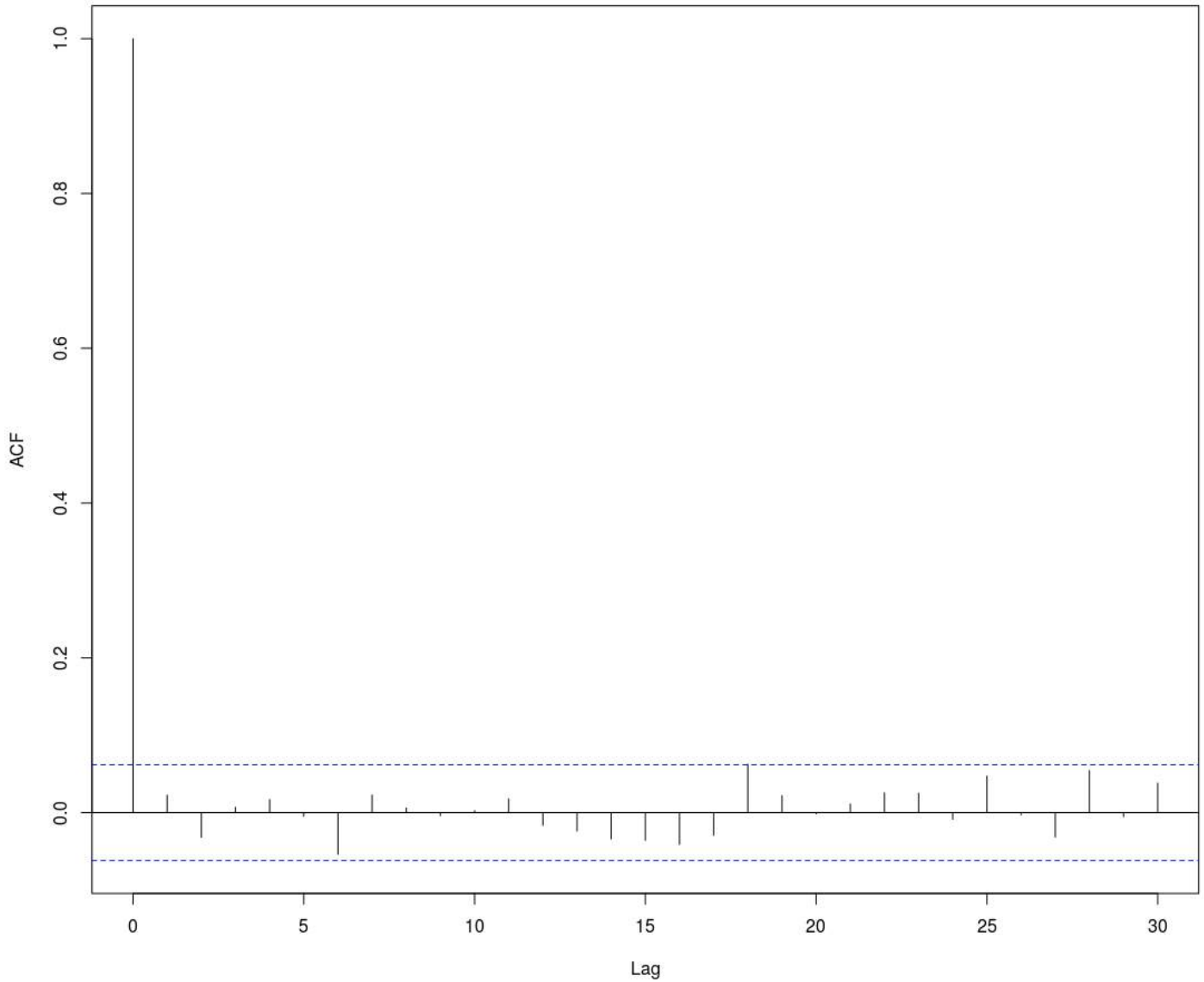
```
#Verify that the model eliminates the autocorrelation
acf(x)
```

Series 1



```
acf(fit$resid)
```

Series fit\$resid



```
#Forecast 10 periods
fcst <- forecast(fit, h = 100)
fcst
  Point Forecast      Lo 80      Hi 80      Lo 95      Hi 95
1001    0.282529070 -0.9940493  1.559107 -1.669829  2.234887
1002    0.173976408 -1.3872262  1.735179 -2.213677  2.561630
1003    0.097554408 -1.5869850  1.782094 -2.478726  2.673835
1004    0.043752667 -1.6986831  1.786188 -2.621073  2.708578
1005    0.005875783 -1.7645535  1.776305 -2.701762  2.713514
...

#Call the point predictions
fcst$mean
# Time Series:
# Start = 1001
# End = 1100
# Frequency = 1
 [1]  0.282529070  0.173976408  0.097554408  0.043752667  0.005875783 -0.020789866 -0.039562711
-0.052778954
 [9] -0.062083302
...
```

```
#Plot the forecast  
plot(fcst)
```

Forecasts from ARIMA(1,0,0) with non-zero mean

