

# Estimación de parámetros para AR(3)

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## Información de contacto

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## AR(3)

### Descripción

Vamos a estimar los parámetros de una simulación para un AR(3) de 9000 observaciones. El modelo a simular es:

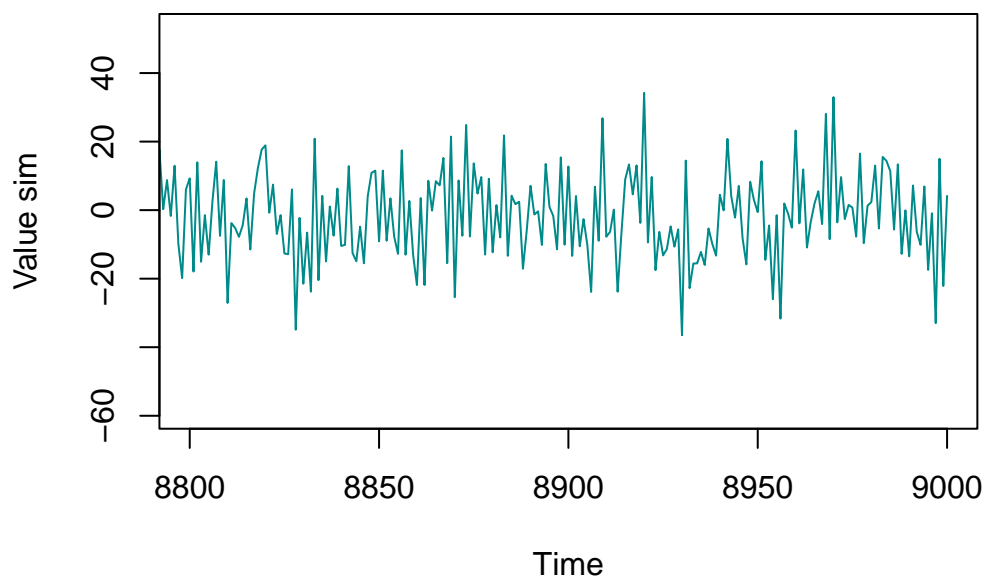
$$\begin{aligned}x_t &= \phi_1 x_{t-1} + \phi_2 x_{t-2} + \phi_3 x_{t-3} + Z_t \\ \phi_1 &= -\frac{1}{7} \\ \phi_2 &= \frac{1}{2} \\ \phi_3 &= \frac{1}{9} \\ Z_t &\sim N(0, 12) \\ t &= 1, 2, \dots, 8000\end{aligned}$$

### Visualización

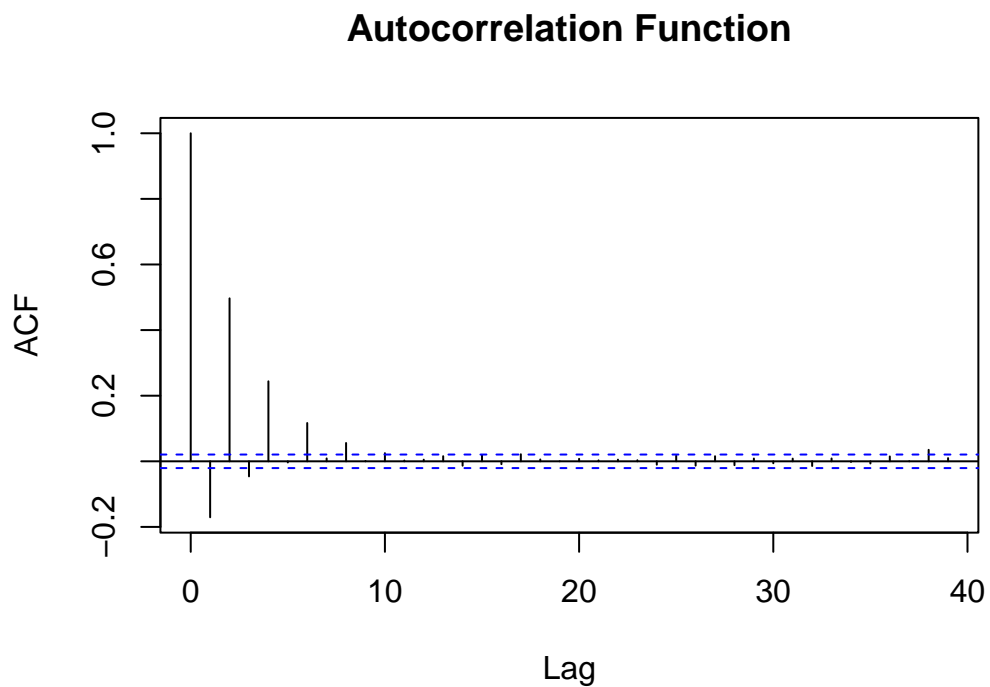
Simulando el proceso anterior AR(3), viendo el gráfico correspondiente (últimas 200 observaciones) y mostrando las primeras 20 observaciones

```
## [1] 21.208009 -7.291541 12.047150 -26.391970 17.155079 -11.017336
## [7] -15.649191 -15.855697 -2.227896 -19.340788 -17.878337 5.178570
## [13] 2.612553 13.951557 -9.692816 17.213257 -5.581159 21.110703
## [19] -5.842364 1.973626
```

### Ar(3) simulado

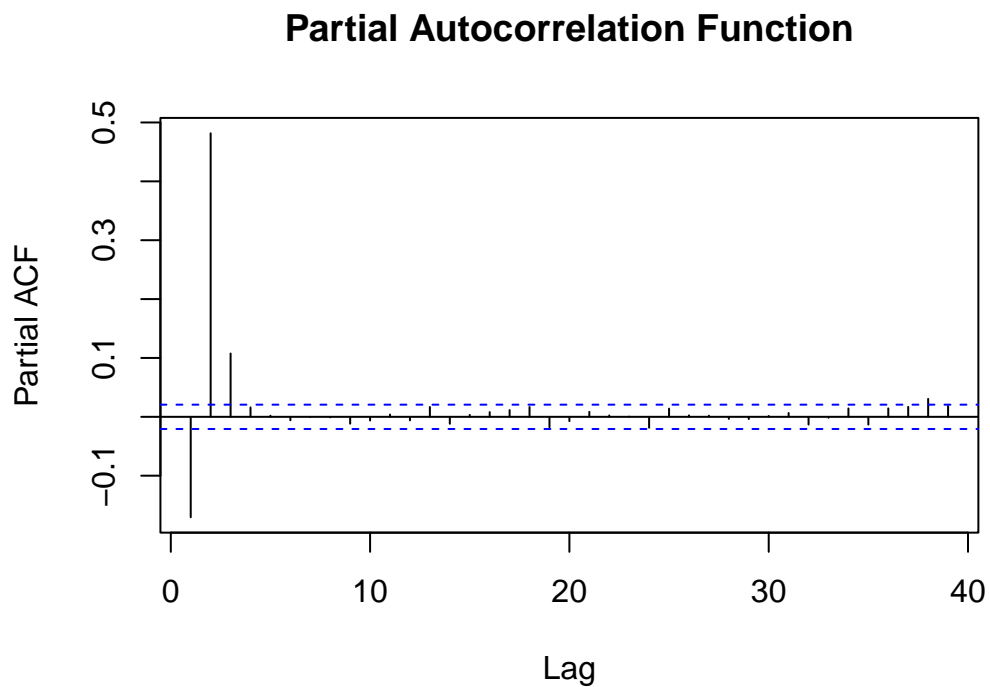


## ACF



```
##
## Autocorrelations of series 'ar3.process', by lag
##
##      0      1      2      3      4      5      6      7      8      9     10
## 1.000 -0.171  0.497 -0.046  0.244 -0.004  0.117  0.009  0.056  0.001  0.025
##    11     12     13     14     15     16     17     18     19     20     21
## 0.002  0.005  0.016 -0.013  0.020 -0.009  0.021  0.006  0.000  0.008  0.003
##    22     23     24     25     26     27     28     29     30     31     32
## 0.005  0.003 -0.010  0.017 -0.013  0.015 -0.012  0.009 -0.006  0.008 -0.014
##    33     34     35     36     37     38     39
## 0.009 -0.002 -0.007  0.015  0.000  0.035  0.010
```

## PACF



```
##
## Partial autocorrelations of series 'ar3.process', by lag
##
##      1      2      3      4      5      6      7      8      9     10     11
## -0.171  0.482  0.108  0.016  0.002 -0.006  0.000 -0.001 -0.012 -0.006  0.004
##      12     13     14     15     16     17     18     19     20     21     22
## -0.006  0.017 -0.012  0.003  0.008  0.012  0.017 -0.018 -0.007  0.008  0.002
##      23     24     25     26     27     28     29     30     31     32     33
##  0.000 -0.019  0.014  0.002  0.002 -0.004 -0.004  0.001  0.007 -0.013 -0.002
##      34     35     36     37     38     39
##  0.014 -0.013  0.014  0.017  0.030  0.018
```

## Estimando parámetros

Para estimar los parámetros  $\hat{\phi}_i$  para  $i = 1, 2, 3$  se debe resolver el sistema:

$$b = R\hat{\phi}$$

Equivalente a:

$$\begin{bmatrix} r_1 \\ r_2 \\ r_3 \end{bmatrix} = \begin{bmatrix} 1 & r_1 & r_2 \\ r_1 & 1 & r_1 \\ r_2 & r_1 & 1 \end{bmatrix} = \begin{bmatrix} \hat{\phi}_1 \\ \hat{\phi}_2 \\ \hat{\phi}_3 \end{bmatrix}$$

Donde  $b$  es igual a:

```
##           [,1]
## [1,] -0.17066480
## [2,]  0.49676043
## [3,] -0.04593968
```

Donde nuestra matriz  $R$  es:

```
##           [,1]      [,2]      [,3]
## [1,]  1.0000000 -0.1706648  0.4967604
## [2,] -0.1706648  1.0000000 -0.1706648
## [3,]  0.4967604 -0.1706648  1.0000000
```

De tal modo resolviendo se tiene que:

```
## [1] -0.1402744  0.4911789  0.1075700
```

## Estimando la varianza

Estimando la varianza del modelo AR(3) simulado es:

```
## [1] 145.7183
```

Cuya desviación del modelo AR(3) simulado es:

```
## [1] 12.07138
```

## Comparando parámetros por linea de comando

```
##  
## Call:  
## arima(x = ar3.process, order = c(3, 0, 0), include.mean = FALSE)  
##  
## Coefficients:  
##          ar1      ar2      ar3  
##      -0.1402  0.4913  0.1075  
## s.e.    0.0105  0.0092  0.0105  
##  
## sigma^2 estimated as 145.7:  log likelihood = -35187.57,  aic = 70383.15
```