

# Ejemplo: validación del supuesto de linealidad

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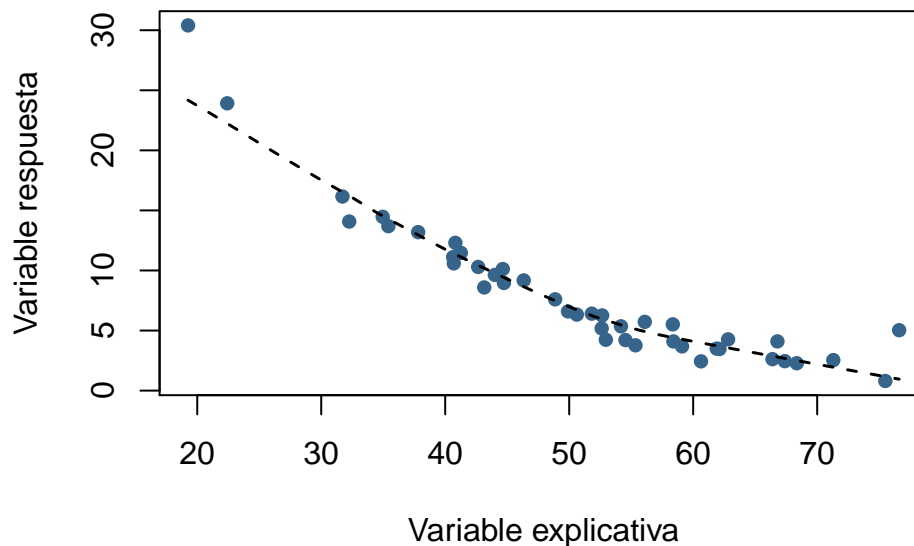
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## Descripción del conjunto de datos

$$Y_i = 80 \exp\{-0.05x_i\} + \epsilon_i, \quad \epsilon_i \sim N(0, 4), \quad i = 1, \dots, 42.$$

```
set.seed(130419)
x <- rnorm(42, 50, 15)
y <- 80*exp(-0.05*x) + rnorm(42, 0, 1)

par(mar = c(4, 4, 1, 1))
plot(x, y, pch = 16, col = 'steelblue4',
     xlab = 'Variable explicativa', ylab = 'Variable respuesta')
lines(loess.smooth(x,y), lwd = 1.5, lty = 2)
```



## Ajuste del modelo lineal

```
lm.fit <- lm(y ~ x)
summary(lm.fit)

##
## Call:
## lm(formula = y ~ x)
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.9617 -1.3655 -0.5790  0.4909  9.7810
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept) 28.29344    1.54026   18.37  <2e-16
```

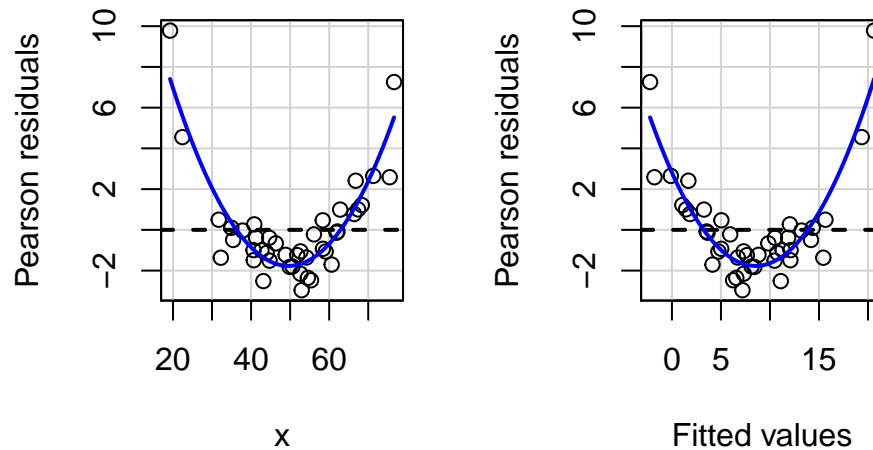
```
## x          -0.39840    0.02928  -13.61   <2e-16
##
## Residual standard error: 2.514 on 40 degrees of freedom
## Multiple R-squared:  0.8223, Adjusted R-squared:  0.8179
## F-statistic: 185.1 on 1 and 40 DF,  p-value: < 2.2e-16
```

## Validación del supuesto de linealidad

```
library(car)
```

```
## Loading required package: carData
```

```
residualPlots(lm.fit, tukey = TRUE)
```



```
##          Test stat Pr(>|Test stat|)
## x          13.93    < 2.2e-16
## Tukey test   13.93    < 2.2e-16
```

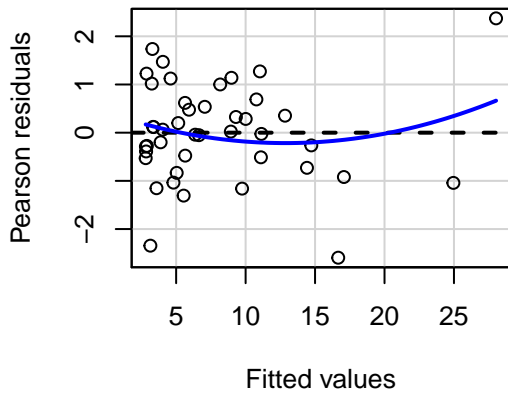
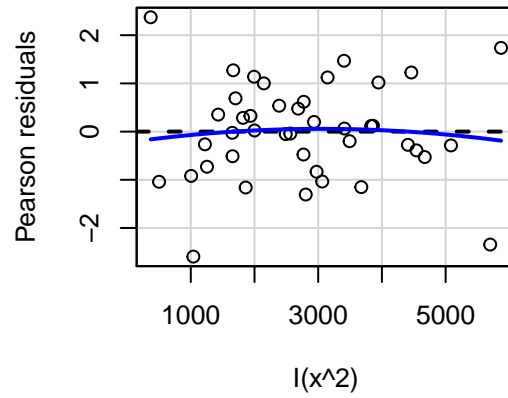
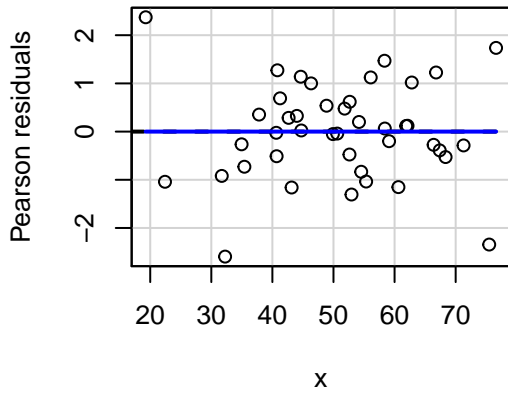
## Ajuste del modelo cuadrático

```
nlm.fit <- lm(y ~ x + I(x^2))
summary(nlm.fit)
```

```
##
## Call:
## lm(formula = y ~ x + I(x^2))
##
## Residuals:
##      Min       1Q   Median       3Q      Max
## -2.59430 -0.52429 -0.00111  0.59791  2.37237
##
## Coefficients:
##              Estimate Std. Error t value Pr(>|t|)
## (Intercept)  51.0586714  1.7544660   29.10  <2e-16
## x           -1.3879916  0.0720704  -19.26  <2e-16
## I(x^2)        0.0099788  0.0007164   13.93  <2e-16
##
## Residual standard error: 1.042 on 39 degrees of freedom
## Multiple R-squared:  0.9703, Adjusted R-squared:  0.9687
## F-statistic: 636.3 on 2 and 39 DF,  p-value: < 2.2e-16
```

# Validación del supuesto de linealidad

```
residualPlots(nlm.fit, tukey = TRUE)
```



##	Test stat	Pr(> Test stat )
## x	1.7900	0.08143
## $I(x^2)$	-1.1701	0.24923
## Tukey test	1.6961	0.08987