ITBA
Instituto Tecnológico
de Buenos Aires

23/OCTUBRE

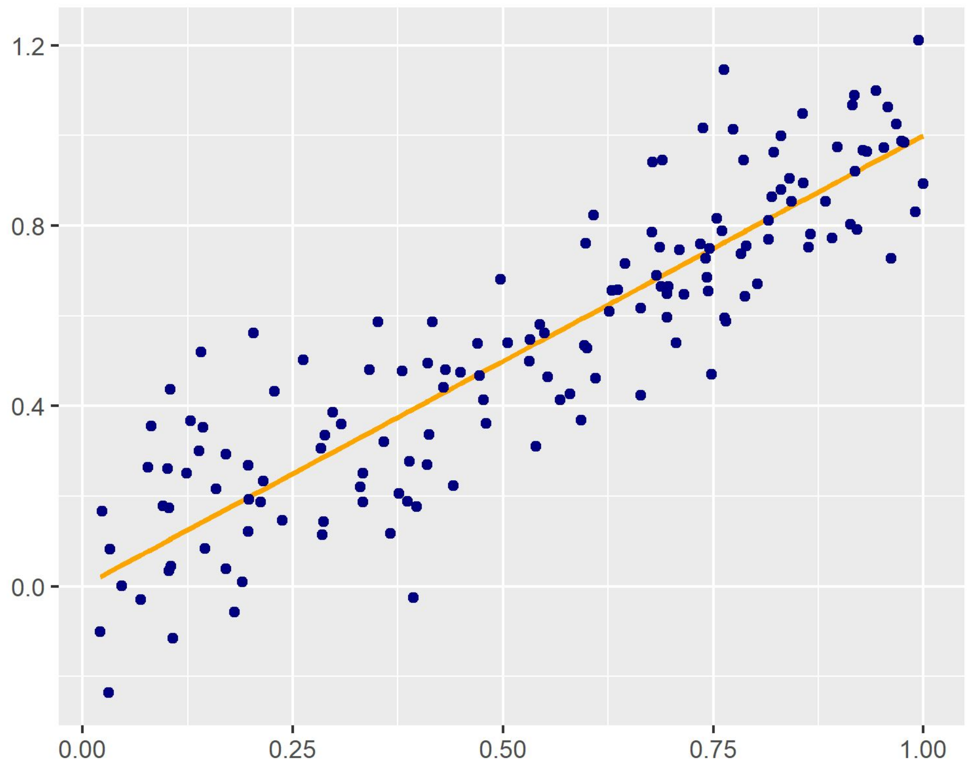
MODELO LINEAL

EXTENSIONES

El modelo lineal

$$y = f(x) + \varepsilon$$

$$y = \beta_0 + \beta_1 x_1 + \beta_2 x_2 + \ldots + \beta_p x_p + \varepsilon$$



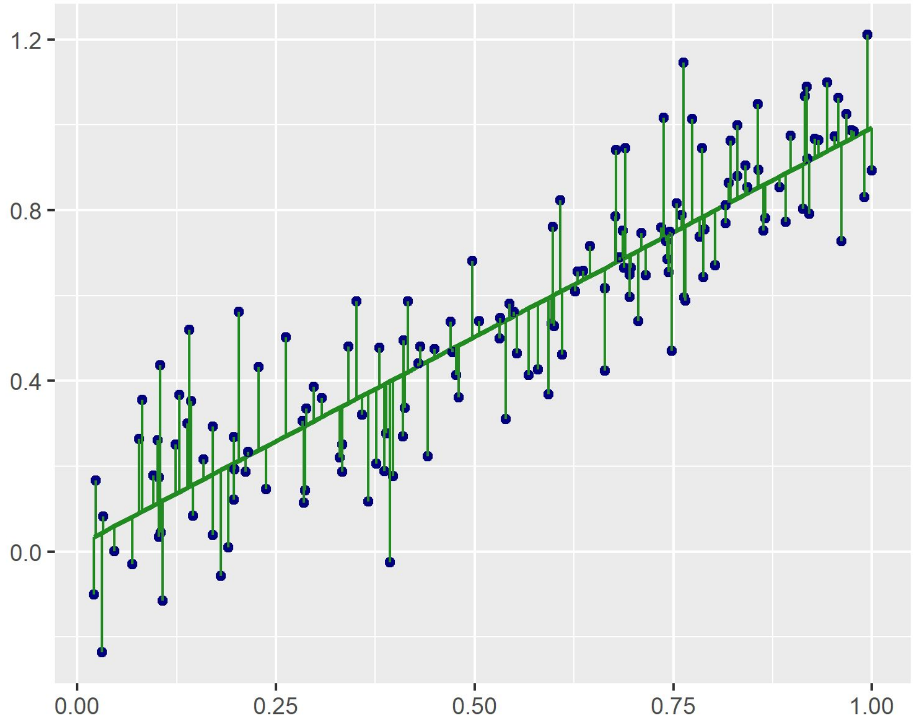
$$\frac{dy}{dx_j} = \beta_j$$

¿Cómo se interpreta Bj?

Estimación por MCO

$$\min \; SCR = \sum_{i=1}^{n} (y_i - \hat{y}_i)^2$$

$$\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_{1i} + \hat{\beta}_2 x_{2i} + \ldots + \hat{\beta}_p x_{pi}$$

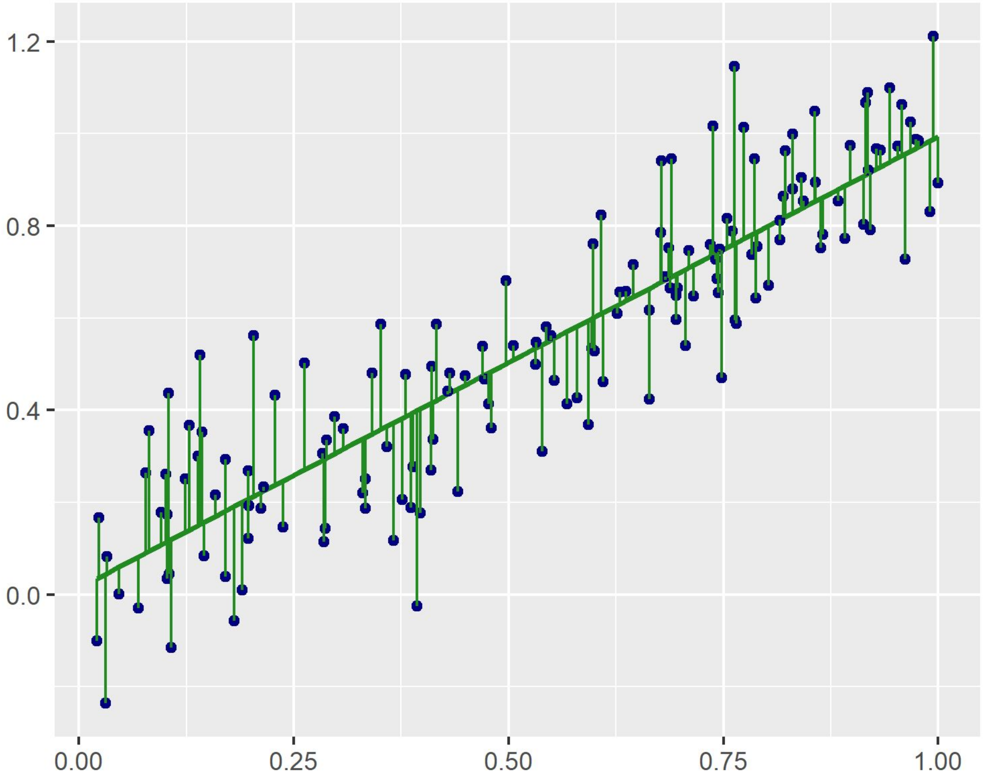


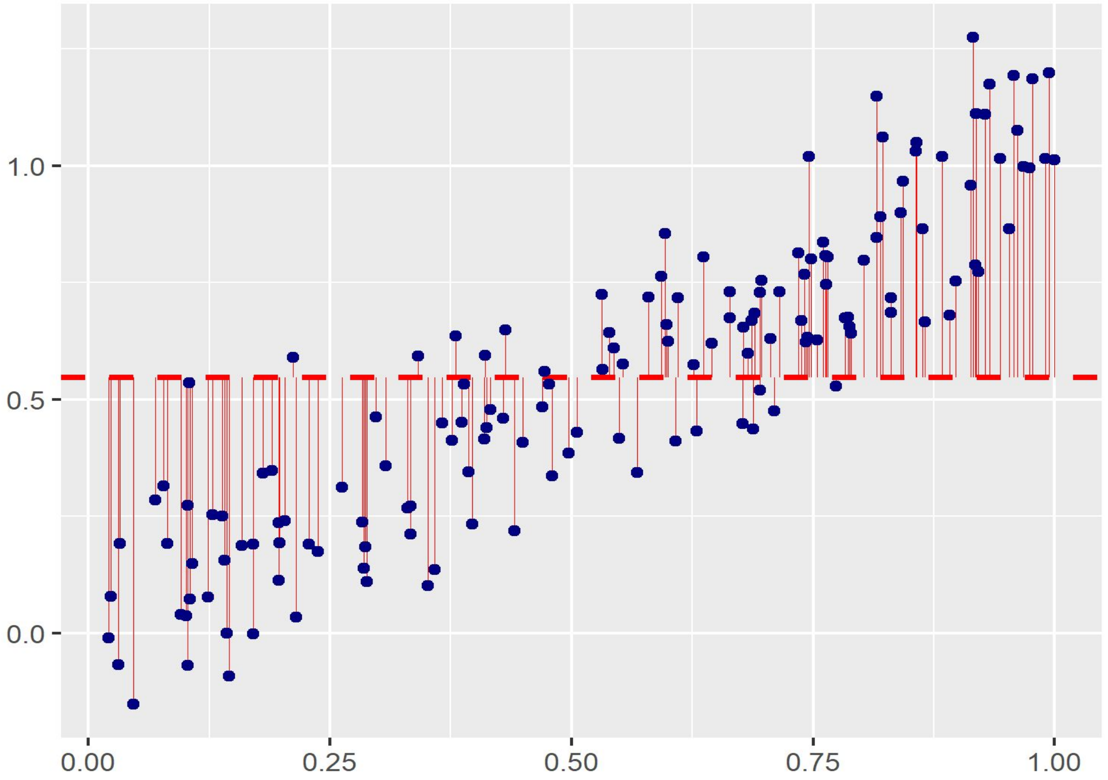
Bondad de ajuste

SCR

$$R^2(y,\hat{y}) = 1 - \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{\sum_{i=1}^{n}(y_i - \bar{y})^2}$$

SCT





Atributos categóricos

$$educ = \begin{cases} \text{primario} \\ \text{secundario} \\ \text{universitario} \end{cases}$$

$$educ_{\mathrm{U}} = \begin{cases} 1 & \text{univ.} \\ 0 & \text{NO univ.} \end{cases}$$

$$educ_{\mathrm{S}} = \begin{cases} 1 & \text{sec.} \\ 0 & \text{NO sec.} \end{cases}$$

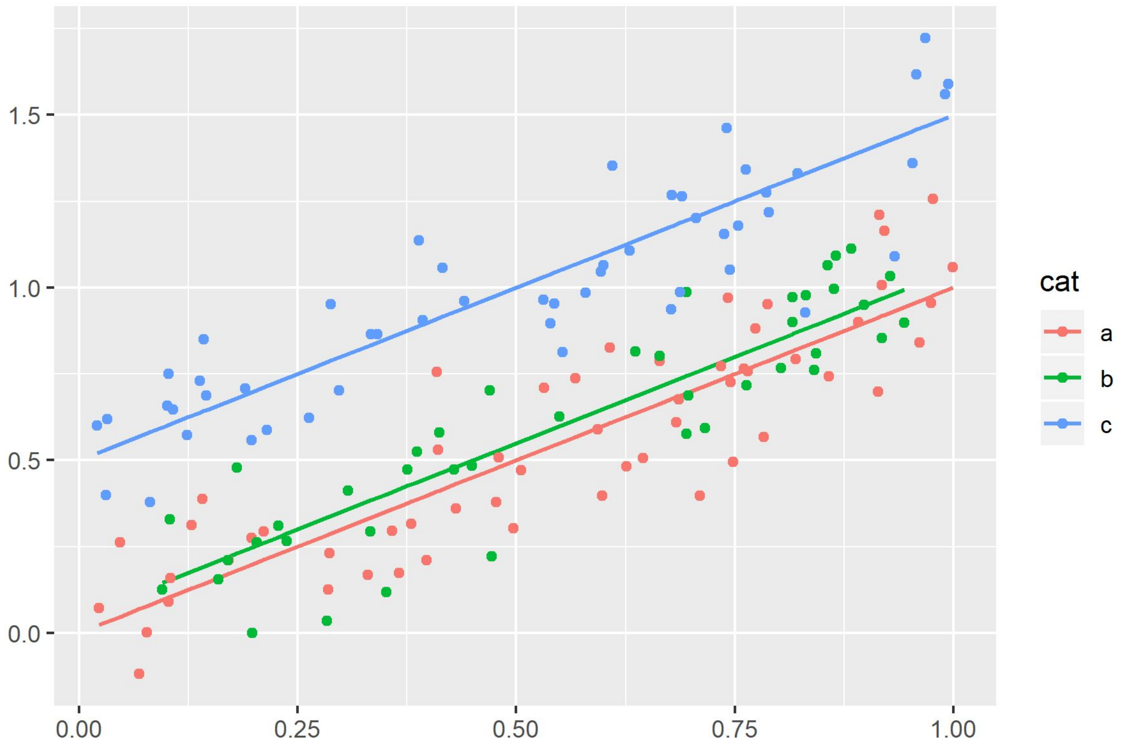
dummies / flags

$$y = \beta_0 + \beta_1 exp + \beta_2 educ_{\mathrm{U}} + \beta_3 educ_{\mathrm{S}} + \epsilon$$

$$y = \begin{cases} (\beta_0 + \beta_2) + \beta_1 exp + \epsilon & \text{univ.} \\ (\beta_0 + \beta_3) + \beta_1 exp + \epsilon & \text{sec.} \\ \beta_0 + \beta_1 exp + \epsilon & \text{prim.} \end{cases}$$

Atributos categóricos

$$y = \beta_0 + \beta_1 exp + \beta_2 educ_{\mathrm{U}} + \beta_3 educ_{\mathrm{S}} + \epsilon$$



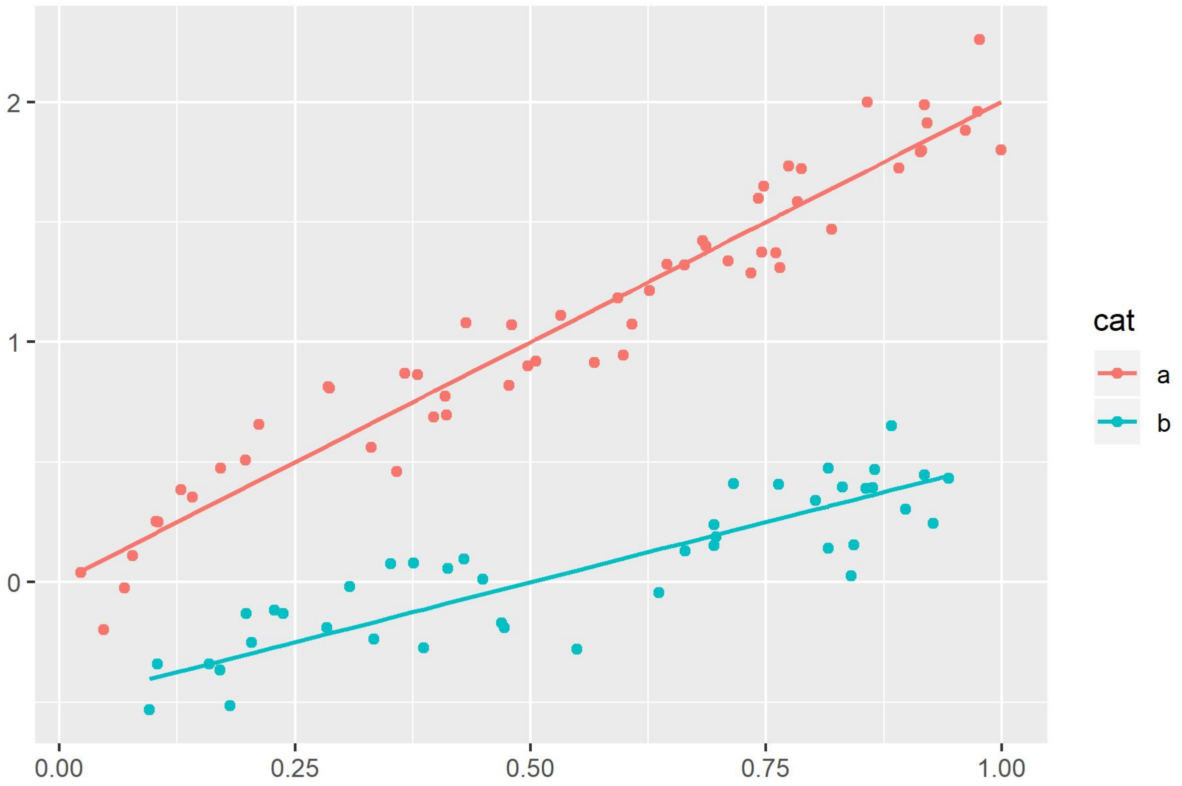
$$educ_{\mathrm{U}} = \begin{cases} 1 & \text{univ.} \\ 0 & \text{NO univ.} \end{cases}$$

$$educ_{\mathrm{S}} = \begin{cases} 1 & \text{sec.} \\ 0 & \text{NO sec.} \end{cases}$$

```
Coefficients:
            Estimate Std. Error t value Pr(>|t|)
(Intercept) 0.007509   0.030774   0.244    0.808
x           0.993354   0.042606  23.315   <2e-16 ***
catb        0.045692   0.030489   1.499    0.136
catc        0.483520   0.028832  16.770   <2e-16 ***
---
Signif. codes:  0 '***' 0.001 '**' 0.01 '*' 0.05 '.' 0.1 ' ' 1
```

Interacciones

$$y = \beta_0 + \beta_1 exp + \beta_2 inf + \beta_3 exp \cdot inf + \epsilon$$



$$informal = \begin{cases} 1 & \text{informal} \\ 0 & \text{caso contrario} \end{cases}$$

$$\frac{dy}{dexp} = \begin{cases} \beta_1 + \beta_3 & \text{informal} \\ \beta_1 & \text{caso contrario} \end{cases}$$

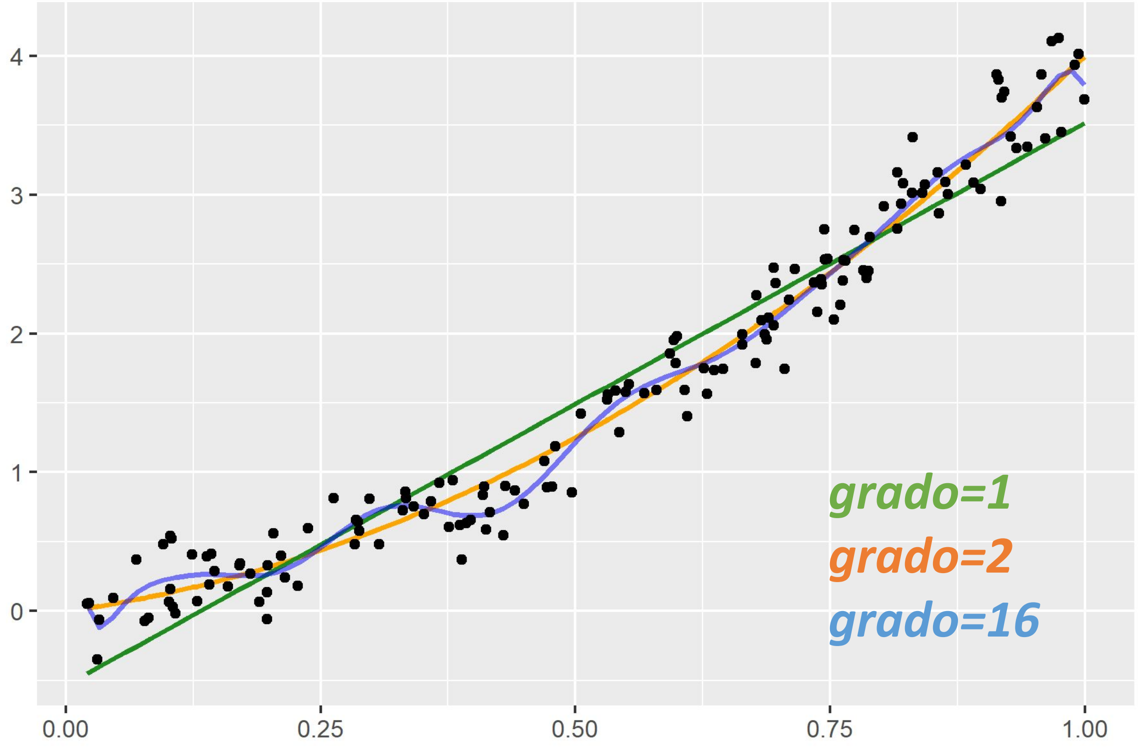
```
Coefficients:
             Estimate Std. Error t value Pr(>|t|)
(Intercept)  0.004983   0.043494   0.115    0.909
x            1.991350   0.070244  28.349  < 2e-16 ***
catb        -0.466229   0.067880  -6.868 6.95e-10 ***
x:catb      -1.052446   0.109473  -9.614 1.22e-15 ***
```

No linealidades

$$y = \beta_0 + \beta_1 x + \beta_2 x^2 + \varepsilon$$

$$\frac{dy}{dx} = \beta_1 + 2\beta_2 x$$

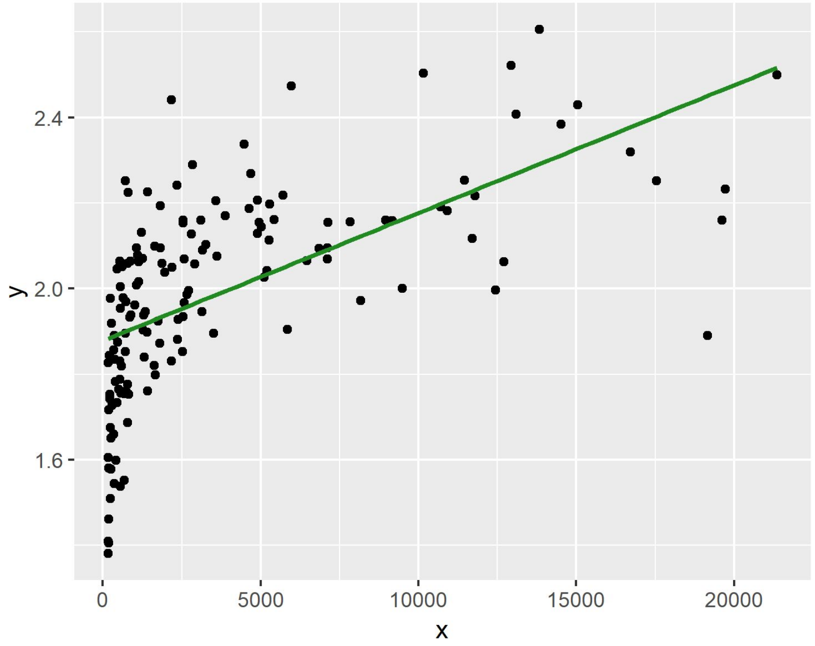
Regresión polinómica




```
Coefficients:
                    Estimate Std. Error t value Pr(>|t|)
(Intercept)          0.04795    0.05441   0.881  0.37952
poly(x, 2, raw = T)1 0.76903    0.24570   3.130  0.00211 **
poly(x, 2, raw = T)2 3.18956    0.23365  13.651  < 2e-16 ***
---
Signif. codes:  0 ‘***’ 0.001 ‘**’ 0.01 ‘*’ 0.05 ‘.’ 0.1 ‘ ’ 1
```

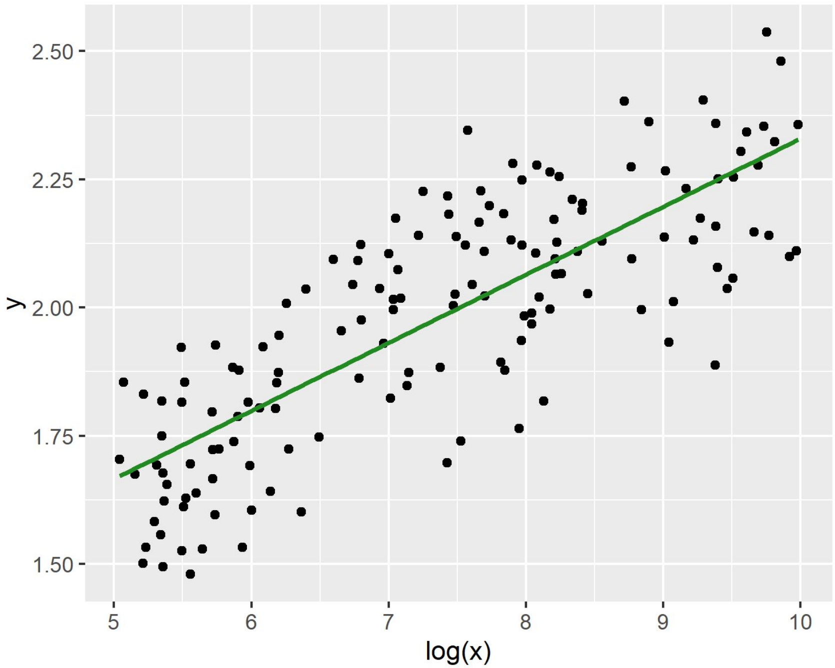
No linealidades

$$y = \beta_0 + \beta_1 x + \epsilon$$



lin-log

$$y = \beta_0 + \beta_1 \ln x + \epsilon$$

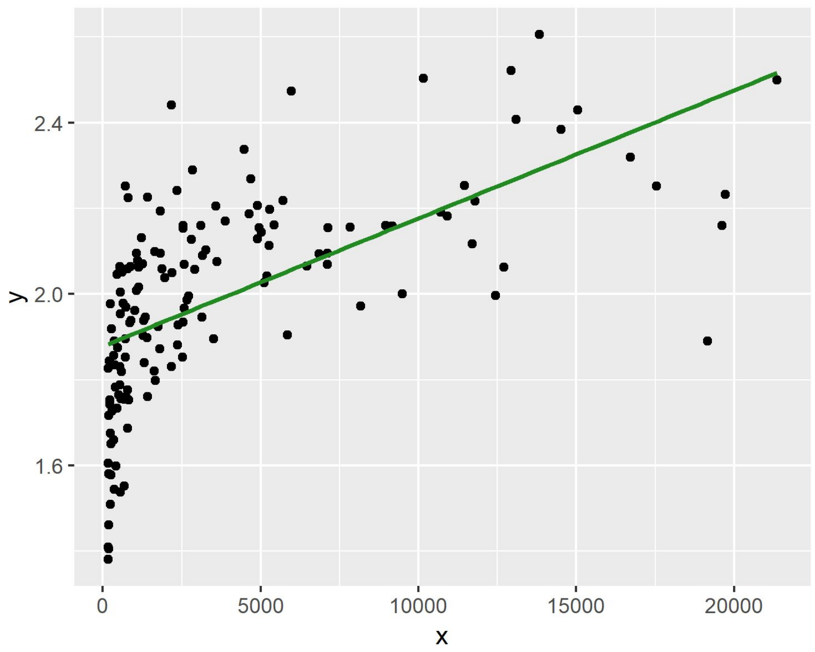


$$\beta_1 = \frac{dy}{dx/x}$$

$$100\beta_1 = \frac{\Delta y}{\Delta \% x}$$

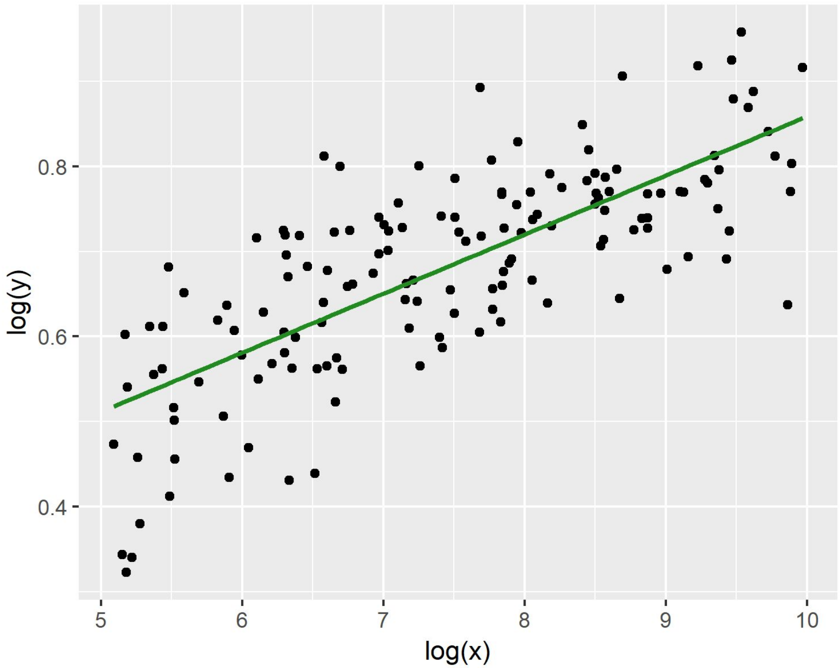
No linealidades

$$y = \beta_0 + \beta_1 x + \varepsilon$$



log-log

$$\ln y = \beta_0 + \beta_1 \ln x + \varepsilon$$



$$\beta_1 = \frac{dy/y}{dx/x}$$

$$\beta_1 = \frac{\Delta\% y}{\Delta\% x}$$

OJO! acá estamos prediciendo otra cosa

No linealidades