**Econometría 06169** | **Fórmulas** | **Examen Parcial #1**

**Prof: Julio César Alonso C**

## MAS sin reposición

$$\frac{n}{N} \qquad \frac{N!}{n!(N-n)!} \qquad \frac{n!(N-n)!}{N!}$$

$$S_{\bar{y}} = \sqrt{\left(1-\frac{n}{N}\right)}\frac{S}{\sqrt{n}} \qquad n = \frac{\frac{z_{\alpha/2}^2 S^2}{\delta^2}}{1+\frac{1}{N}\left(\frac{z_{\alpha/2}^2 S^2}{\delta^2}\right)}$$

$$\hat{P} = \frac{\sum_{i=1}^{n} X_i}{n} \qquad S_{\hat{P}}^2 = \frac{N-n}{N-1}\frac{\hat{P}\hat{Q}}{n} \qquad n_{(P)} = \frac{\frac{z_{\alpha/2}^2 \hat{P}\hat{Q}}{\delta^2}}{\frac{N-1}{N}+\frac{1}{N}\left(\frac{z_{\alpha/2}^2 \hat{P}\hat{Q}}{\delta^2}\right)}$$

## MAS con reposición

$$1-\left(\frac{N-1}{N}\right)^n \qquad N^n \qquad \frac{1}{N^n}$$

$$S_{\bar{y}} = \frac{S}{\sqrt{n}} \qquad n_0 = \frac{z_{\frac{\alpha}{2}}^2 S^2}{\delta^2}$$

$$S_{\hat{P}}^2 = \frac{\hat{P}\hat{Q}}{n} \qquad n_{(p)} = \frac{z_{\alpha/2}^2 \hat{P}\hat{Q}}{\delta^2}$$

## MEA

$W_h = \frac{N_h}{N}$ para $h = 1, 2, \ldots H$

$$n = \sum_{h=1}^{H} n_h$$

$$\bar{y} = \sum_{h=1}^{H} W_h \bar{y}_h \qquad \bar{y}_h = \frac{\sum_{i=1}^{n_h} y_{h,i}}{n_h} \qquad Var[\bar{y}] = \sum_{h=1}^{H} W_h^2 Var[\bar{y}_h]$$

$$S_{\bar{y}_h} = \sqrt{\left(1-\frac{n_h}{N_h}\right)}\frac{S_h}{\sqrt{n_h}} \qquad n = \frac{\frac{z_{\alpha/2}^2\left(\sum_{h=1}^{H} W_h S_H\right)^2}{\delta^2}}{1+\frac{1}{N}\left(\frac{z_{\alpha/2}^2\left(\sum_{h=1}^{H} W_h S_H\right)^2}{\delta^2}\right)}$$

$$n_h = n\frac{W_h S_H}{\sum_{h=1}^{H} W_h S_H}$$

## Muestreo por Conglomerado

$$\bar{y}_{congl} = \frac{\sum_{i=1}^{n_C}\sum_{j=1}^{M} y_{i,j}}{n_C} \qquad \bar{y} = \frac{\sum_{i=1}^{n_C}\sum_{j=1}^{M} y_{i,j}}{n} = \frac{\bar{y}_{congl}}{M}$$

$$S_{congl}^2 = \frac{\sum_{i=1}^{n_C}\left(\left(\sum_{j=1}^{M} y_{i,j}\right)-\bar{y}_{congl}\right)^2}{n_C-1} \qquad S^2 = \frac{\sum_{i=1}^{n_C}\sum_{j=1}^{M}\left(y_{i,j}-\bar{y}\right)^2}{n-1}$$

$$S_{\bar{y}_{congl}}^2 = \frac{N_C\left(N_C-n_C\right)}{n_C}S_{congl}^2 \qquad S_{\bar{y}}^2 = \frac{\left(N_C-n_C\right)}{N_C n_C}\frac{S_{congl}^2}{M^2}$$

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$$n_c = \frac{\frac{z_{\alpha/2}^2 S_{congl}^2}{\delta^2 M^2}}{1+\frac{1}{N_c}\left(\frac{z_{\alpha/2}^2 S_{congl}^2}{\delta^2 M^2}\right)} \quad n = n_c M$$

## Regresión

$$\hat{\beta}_1 = \overline{y} - \hat{\beta}_2 \overline{x} \qquad \hat{\beta}_2 = \frac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{\sum_{i=1}^{n}(x_i - \overline{x})^2} = \frac{\sum_{i=1}^{n} y_i x_i - n\overline{yx}}{\sum_{i=1}^{n} x_i^2 - n\overline{x}^2}$$

$$s^2 = \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{n-2} = \frac{\sum_{i=1}^{n}\hat{\varepsilon}_i^2}{n-2}$$

$$Var\left[\hat{\beta}\right] = \begin{bmatrix} Var\left[\hat{\beta}_1\right] & Cov\left[\hat{\beta}_1, \hat{\beta}_2\right] \\ Cov\left[\hat{\beta}_1, \hat{\beta}_2\right] & Var\left[\hat{\beta}_2\right] \end{bmatrix} = \begin{bmatrix} \frac{\sum_{i=1}^{n} x_i^2}{n\sum_{i=1}^{n}(x_i - \overline{x})^2}\sigma^2 & \frac{-\overline{x}}{\sum_{i=1}^{n}(x_i - \overline{x})^2}\sigma^2 \\ \frac{-\overline{x}}{\sum_{i=1}^{n}(x_i - \overline{x})^2}\sigma^2 & \frac{1}{\sum_{i=1}^{n}(x_i - \overline{x})^2}\sigma^2 \end{bmatrix}$$

$$SSR = \sum_{i=1}^{n}(\hat{y}_i - \overline{y})^2 \quad SST = \sum_{i=1}^{n}(y_i - \overline{y})^2 \quad SSE = \sum_{i=1}^{n}(y_i - \hat{y}_i)^2$$

$$r^2 = \frac{SSR}{SST}$$

$$\hat{y} \pm t_{\alpha/2, n-2}\, s \sqrt{1 + \frac{1}{n} + \frac{(x_p - \overline{x})^2}{\sum_{i=1}^{n}(x_i - \overline{x})^2}}$$

$$\hat{y} \pm t_{\alpha/2, n-2}\, s \sqrt{\frac{1}{n} + \frac{(x_p - \overline{x})^2}{\sum_{i=1}^{n}(x_i - \overline{x})^2}}$$

$$X^T X = \begin{bmatrix} n & \sum_{i=1}^{n} X_{1i} & \sum_{i=1}^{n} X_{2i} & \cdots & \sum_{i=1}^{n} X_{ki} \\ & \sum_{i=1}^{n} X_{1i}^2 & \sum_{i=1}^{n} X_{1i}X_{2i} & \cdots & \sum_{i=1}^{n} X_{1i}X_{ki} \\ & & \sum_{i=1}^{n} X_{2i}^2 & \ddots & \sum_{i=1}^{n} X_{2i}X_{ki} \\ & & & \ddots & \vdots \\ & & & & \sum_{i=1}^{n} X_{ki}^2 \end{bmatrix}$$

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$$X^T y = \begin{bmatrix} \sum_{i=1}^{n} y_i \\ \sum_{i=1}^{n} y_i X_{1i} \\ \sum_{i=1}^{n} y_i X_{2i} \\ \vdots \\ \sum_{i=1}^{n} y_i X_{ki} \end{bmatrix}$$

$$y^T y = \sum_{i=1}^{n} y_i^2$$

| $n$ | $t_{0.01,n-2}$ |
|---|---|
| **120** | **2.357** |

$$\hat{\beta} = \left(X^T X\right)^{-1} X^T y$$

$$s^2 = \frac{SSE}{n-k} = \frac{y^T y - \hat{\beta}^T X^T y}{n-k}$$

$$\hat{\beta}_i \pm t_{\frac{\alpha}{2},n-k} s_{\hat{\beta}_i}$$

$$t = \frac{\hat{\beta}_i - c}{s_{\hat{\beta}_i}}$$

## Cantidades Importantes

$\sqrt{2} = 1.414$ $\sqrt{3} = 1.732$ $\sqrt{5} = 2.236$ $\sqrt{7} = 2.646$ $\sqrt{10} = 3.162$ $\sqrt{13} = 3.606$

## Valores críticos de la distribución normal y t

| $\alpha$ | $z_{\frac{\alpha}{2}}$ | $z_{\alpha}$ |
|---|---|---|
| **0.01** | **2.58** | **2.33** |
| **0.05** | **1.96** | **1.64** |
| **0.1** | **1.64** | **1.28** |

**Econometría, Examen Parcial II**

**Prof: Julio César Alonso C**

## Fórmulas

$$X^T X = \begin{bmatrix} n & \sum_{i=1}^n X_{1i} & \sum_{i=1}^n X_{2i} & \cdots & \sum_{i=1}^n X_{ki} \\ & \sum_{i=1}^n X_{1i}^2 & \sum_{i=1}^n X_{1i}X_{2i} & \cdots & \sum_{i=1}^n X_{1i}X_{ki} \\ & & \sum_{i=1}^n X_{2i}^2 & \ddots & \sum_{i=1}^n X_{2i}X_{ki} \\ & & & \ddots & \vdots \\ & & & & \sum_{i=1}^n X_{ki}^2 \end{bmatrix}$$

$$X^T y = \begin{bmatrix} \sum_{i=1}^n y_i \\ \sum_{i=1}^n y_i X_{1i} \\ \sum_{i=1}^n y_i X_{2i} \\ \vdots \\ \sum_{i=1}^n y_i X_{ki} \end{bmatrix} \qquad y^T y = \sum_{i=1}^n y_i^2$$

$$SST = \sum_{i=1}^n \left(y_i - \bar{y}\right)^2 = y^T y - n\bar{Y}^2 \qquad SSE = \sum_{i=1}^n \left(y_i - \hat{y}_i\right)^2$$

$$\hat{\beta} = \left(X^T X\right)^{-1} X^T y \qquad s^2 = \frac{SSE}{n-k} = \frac{y^T y - \hat{\beta}^T X^T y}{n-k}$$

$$Var\left[\hat{\beta}\right] = \sigma^2 \left(X^T X\right)^{-1}$$

$$SSR = \sum_{i=1}^n \left(\hat{y}_i - \bar{y}\right)^2 = \hat{\beta}^T X^T y - n\bar{Y}^2 \qquad t = \frac{\hat{\beta}_i - c}{s_{\hat{\beta}_i}}$$

$$F_c = \frac{\left(c - R\hat{\beta}\right)^T \left(R\left(X^T X\right)^{-1} R^T\right)^{-1} \left(c - R\hat{\beta}\right) / r}{SSE / n-k}$$

$$F_C = \frac{R^2 / (k-1)}{\left(1-R^2\right) / (n-k)} = \frac{MSR}{MSE}$$

$$F_c = \frac{\left(SSE_R - SSE_U\right) / r}{SSE_U / (n-k)} \qquad R^2 = \frac{SSR}{SST}$$

$$\hat{\beta}_i \pm t_{\frac{\alpha}{2}, n-k} s_{\hat{\beta}_i} \qquad \bar{R}^2 = 1 - \left(1 - R^2\right) \frac{n-1}{n-k}$$

$$\hat{y}_p = x_p^T \hat{\beta} \quad , \quad x_p^T = \left(1 \quad x_{1p} \quad x_{2p} \quad \ldots \quad x_{kp}\right)$$

$$\hat{y}_p \pm t_{\frac{\alpha}{2}, n-k} \sqrt{\sigma^2 x_p^T \left(X^T X\right)^{-1} x_p}$$

$$\hat{y}_p \pm t_{\frac{\alpha}{2}, n-k} \sqrt{\sigma^2 \left[1 + x_p^T \left(X^T X\right)^{-1} x_p\right]}$$

$$\hat{\beta}_j^E = \hat{\beta}_j \frac{s_{X_j}}{s_y} \quad , \quad j = 2,3,\ldots,k \qquad E_j = \hat{\beta}_j \frac{\bar{X}_j}{\bar{y}}$$

## Econometría, Examen Parcial II

## Prof: Julio César Alonso C

### Test de Heteroscedasticidad

***Goldfeld y Quand:*** $F_{GQ} = \frac{SSE_2}{SSE_1} \sim F_{(n-d-2k, n-d-2k)}$

***Breush-Pagan:*** $\frac{\hat{\varepsilon}_i^2}{\hat{\sigma}^2} = \gamma + \delta Z_i + \mu_i$, $BP = \frac{SSR}{2} \sim \chi_g^2$

***White:*** $\hat{\varepsilon}_i^2 = \gamma + \sum_{m=1}^{k}\sum_{j=1}^{k} \delta_s X_{mi} X_{ji} + \mu_i$, $W_a = nR^2 \sim \chi_g^2$

### Test de Autocorrelación

***Durbin-Watson*** $DW \approx 2(1-\hat{\rho})$

| *Ho* | *Sí* | *Decisión* |
|---|---|---|
| $H_0 : \rho = 0$ | $d_u < DW < 4 - d_u$ | ***A*** |
| ***No auto +*** | $0 < DW < d_l$ | ***R*** |
| ***No auto -*** | $4 - d_l < DW < 4$ | ***R*** |

***Área de indecisión*** $d_l < DW < d_u$ ***y*** $4 - d_u < DW < 4 - d_l$

### Cantidades Importantes

$\sqrt{2} = 1.414$ $\sqrt{3} = 1.732$
$\sqrt{10} = 3.162$ $\sqrt{13} = 3.606$

***$d_l$ y $d_u$ para el test de DW al nivel de significancia del 5%***

| *N* | *k-1=1* | | *k-1=2* | | *k-1=3* | |
|---|---|---|---|---|---|---|
| | $d_l$ | $d_u$ | $d_l$ | $d_u$ | $d_l$ | $d_u$ |
| *50* | *1.50* | *1.59* | *1.46* | *1.63* | *1.42* | *1.67* |
| *60* | *1.55* | *1.62* | *1.51* | *1.65* | *1.48* | *1.69* |
| *95* | *1.64* | *1.69* | *1.62* | *1.71* | *1.60* | *1.73* |
| *100* | *1.65* | *1.69* | *1.63* | *1.72* | *1.61* | *1.74* |

***Condición de Orden***

$k_i > g_i - 1$ sobre-identificada

$k_i = g_i - 1$ perfectamente identificada

## MAS sin reposición

$$\frac{n}{N} \qquad \frac{N!}{n!(N-n)!} \qquad \frac{n!(N-n)!}{N!}$$

$$S_{\bar{y}} = \sqrt{\left(1-\frac{n}{N}\right)}\frac{S}{\sqrt{n}} \qquad n = \frac{\frac{z_{\alpha/2}^2 S^2}{\delta^2}}{1+\frac{1}{N}\left(\frac{z_{\alpha/2}^2 S^2}{\delta^2}\right)}$$

$$\hat{P} = \frac{\sum_{i=1}^{n} X_i}{n} \qquad S_{\hat{P}}^2 = \frac{N-n}{N-1}\frac{\hat{P}\hat{Q}}{n} \qquad n_{(P)} = \frac{\frac{z_{\alpha/2}^2 \hat{P}\hat{Q}}{\delta^2}}{\frac{N-1}{N}+\frac{1}{N}\left(\frac{z_{\alpha/2}^2 \hat{P}\hat{Q}}{\delta^2}\right)}$$

## MAS con reposición

$$1-\left(\frac{N-1}{N}\right)^n \qquad N^n \qquad \frac{1}{N^n}$$

$$S_{\bar{y}} = \frac{S}{\sqrt{n}} \qquad n_0 = \frac{z_{\frac{\alpha}{2}}^2 S^2}{\delta^2}$$

$$S_{\hat{P}}^2 = \frac{\hat{P}\hat{Q}}{n} \qquad n_{(p)} = \frac{z_{\alpha/2}^2 \hat{P}\hat{Q}}{\delta^2}$$

## MEA

$W_h = \frac{N_h}{N}$ para $h = 1, 2, \ldots H$ $\qquad n = \sum_{h=1}^{H} n_h$

$$\bar{y} = \sum_{h=1}^{H} W_h \bar{y}_h \qquad \bar{y}_h = \frac{\sum_{i=1}^{n_h} y_{h,i}}{n_h} \qquad Var[\bar{y}] = \sum_{h=1}^{H} W_h^2 Var[\bar{y}_h]$$

$$S_{\bar{y}_h} = \sqrt{\left(1-\frac{n_h}{N_h}\right)}\frac{S_h}{\sqrt{n_h}} \qquad n = \frac{\frac{z_{\alpha/2}^2\left(\sum_{h=1}^{H} W_h S_H\right)^2}{\delta^2}}{1+\frac{1}{N}\left(\frac{z_{\alpha/2}^2\left(\sum_{h=1}^{H} W_h S_H\right)^2}{\delta^2}\right)}$$

$$n_h = n\frac{W_h S_H}{\sum_{h=1}^{H} W_h S_H}$$

## Muestreo por Conglomerado

$$\bar{y}_{congl} = \frac{\sum_{i=1}^{n_C}\sum_{j=1}^{M} y_{i,j}}{n_C} \qquad \bar{y} = \frac{\sum_{i=1}^{n_C}\sum_{j=1}^{M} y_{i,j}}{n} = \frac{\bar{y}_{congl}}{M}$$

$$S_{congl}^2 = \frac{\sum_{i=1}^{n_C}\left(\left(\sum_{j=1}^{M} y_{i,j}\right)-\bar{y}_{congl}\right)^2}{n_C-1} \qquad S^2 = \frac{\sum_{i=1}^{n_C}\sum_{j=1}^{M}\left(y_{i,j}-\bar{y}\right)^2}{n-1}$$

$$S_{\bar{y}_{congl}}^2 = \frac{N_C\left(N_C-n_C\right)}{n_C}S_{congl}^2 \qquad S_{\bar{y}}^2 = \frac{\left(N_C-n_C\right)}{N_C n_C}\frac{S_{congl}^2}{M^2}$$

$$n_c = \frac{\frac{z_{\alpha/2}^2 S_{congl}^2}{\delta^2 M^2}}{1 + \frac{1}{N_c}\left(\frac{z_{\alpha/2}^2 S_{congl}^2}{\delta^2 M^2}\right)} \quad n = n_c M$$

$$X^T X = \begin{bmatrix} n & \sum_{i=1}^{n} X_{1i} & \sum_{i=1}^{n} X_{2i} & \cdots & \sum_{i=1}^{n} X_{ki} \\ & \sum_{i=1}^{n} X_{1i}^2 & \sum_{i=1}^{n} X_{1i}X_{2i} & \cdots & \sum_{i=1}^{n} X_{1i}X_{ki} \\ & & \sum_{i=1}^{n} X_{2i}^2 & \ddots & \sum_{i=1}^{n} X_{2i}X_{ki} \\ & & & \ddots & \vdots \\ & & & & \sum_{i=1}^{n} X_{ki}^2 \end{bmatrix}$$

$$X^T y = \begin{bmatrix} \sum_{i=1}^{n} y_i \\ \sum_{i=1}^{n} y_i X_{1i} \\ \sum_{i=1}^{n} y_i X_{2i} \\ \vdots \\ \sum_{i=1}^{n} y_i X_{ki} \end{bmatrix} \quad y^T y = \sum_{i=1}^{n} y_i^2$$

$$SST = \sum_{i=1}^{n} \left(y_i - \overline{y}\right)^2 = y^T y - n\overline{Y}^2 \qquad SSE = \sum_{i=1}^{n} \left(y_i - \hat{y}_i\right)^2$$

$$\hat{\beta} = \left(X^T X\right)^{-1} X^T y \quad s^2 = \frac{SSE}{n-k} = \frac{y^T y - \hat{\beta}^T X^T y}{n-k}$$

$$Var\left[\hat{\beta}\right] = \sigma^2 \left(X^T X\right)^{-1}$$

$$SSR = \sum_{i=1}^{n} \left(\hat{y}_i - \overline{y}\right)^2 = \hat{\beta}^T X^T y - n\overline{Y}^2 \qquad t = \frac{\hat{\beta}_i - c}{s_{\hat{\beta}_i}}$$

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$$\hat{y}_p = x_p^T \hat{\beta} \quad , \quad x_p^T = \begin{pmatrix} 1 & x_{1p} & x_{2p} & \dots & x_{kp} \end{pmatrix}$$

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**Econometría 06169** **Fórmulas** **Examen Final**

**Prof: Julio César Alonso C**

$$\hat{\beta}_j^E = \hat{\beta}_j \frac{s_{X_j}}{s_y}, \quad j = 2,3,\ldots,k \qquad E_j = \hat{\beta}_j \frac{\overline{X}_j}{\overline{y}}$$

$$h = \hat{\rho}\sqrt{\frac{n}{1-n\left(\widehat{Var(\hat{\alpha})}\right)}}$$ **donde**

$$y_t = \beta_0 + \beta_1 x_{1i} + \ldots + \beta_k x_{ki} + \alpha y_{t-1} + \varepsilon_t$$

## Test de Heteroscedasticidad

**Goldfeld y Quand:** $F_{GQ} = \frac{SSE_2}{SSE_1} \sim F_{(n-d-2k, n-d-2k)}$

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| **No auto +** | $0 < DW < d_l$ | **R** |
| **No auto -** | $4 - d_l < DW < 4$ | **R** |

**Área de indecisión** $d_l < DW < d_u$ **y** $4 - d_u < DW < 4 - d_l$

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| N | k-1=1 | | k-1=2 | | k-1=3 | |
|---|---|---|---|---|---|---|
| | $d_l$ | $d_u$ | $d_l$ | $d_u$ | $d_l$ | $d_u$ |
| 50 | 1.50 | 1.59 | 1.46 | 1.63 | 1.42 | 1.67 |
| 60 | 1.55 | 1.62 | 1.51 | 1.65 | 1.48 | 1.69 |
| 95 | 1.64 | 1.69 | 1.62 | 1.71 | 1.60 | 1.73 |
| 100 | 1.65 | 1.69 | 1.63 | 1.72 | 1.61 | 1.74 |

**Condición de Orden**

$k_i > g_i - 1$ *sobre-identificada*

$k_i = g_i - 1$ *perfectamente identificada*

## Regresión simple

$$\hat{\beta}_1 = \overline{y} - \hat{\beta}_2 \overline{x} \qquad \hat{\beta}_2 = \frac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{\sum_{i=1}^{n}(x_i - \overline{x})^2} = \frac{\sum_{i=1}^{n} y_i x_i - n\overline{yx}}{\sum_{i=1}^{n} x_i^2 - n\overline{x}^2}$$

$$s^2 = \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{n-2} = \frac{\sum_{i=1}^{n}\hat{\varepsilon}_i^2}{n-2}$$

$$Var\left[\hat{\beta}\right] = \begin{bmatrix} Var\left[\hat{\beta}_1\right] & Cov\left[\hat{\beta}_1, \hat{\beta}_2\right] \\ Cov\left[\hat{\beta}_1, \hat{\beta}_2\right] & Var\left[\hat{\beta}_2\right] \end{bmatrix} = \begin{bmatrix} \dfrac{\sum_{i=1}^{n} x_i^2}{n\sum_{i=1}^{n}(x_i - \overline{x})^2}\sigma^2 & \dfrac{-\overline{x}}{\sum_{i=1}^{n}(x_i - \overline{x})^2}\sigma^2 \\ \dfrac{-\overline{x}}{\sum_{i=1}^{n}(x_i - \overline{x})^2}\sigma^2 & \dfrac{1}{\sum_{i=1}^{n}(x_i - \overline{x})^2}\sigma^2 \end{bmatrix}$$

$$SSR = \sum_{i=1}^{n}(\hat{y}_i - \overline{y})^2 \quad SST = \sum_{i=1}^{n}(y_i - \overline{y})^2 \quad SSE = \sum_{i=1}^{n}(y_i - \hat{y}_i)^2$$

$$r^2 = \frac{SSR}{SST} \qquad \hat{\beta}_i \pm t_{\frac{\alpha}{2}, n-k} s_{\hat{\beta}_i} \qquad t = \frac{\hat{\beta}_i - c}{s_{\hat{\beta}_i}}$$

$$\hat{y} \pm t_{\alpha/2, n-2} s \sqrt{1 + \frac{1}{n} + \frac{(x_p - \overline{x})^2}{\sum_{i=1}^{n}(x_i - \overline{x})^2}}$$

$$\hat{y} \pm t_{\alpha/2, n-2} s \sqrt{\frac{1}{n} + \frac{(x_p - \overline{x})^2}{\sum_{i=1}^{n}(x_i - \overline{x})^2}}$$

## Regresión múltiple

$$X^T X = \begin{bmatrix} n & \sum_{i=1}^{n} X_{1i} & \sum_{i=1}^{n} X_{2i} & \cdots & \sum_{i=1}^{n} X_{ki} \\ & \sum_{i=1}^{n} X_{1i}^2 & \sum_{i=1}^{n} X_{1i}X_{2i} & \cdots & \sum_{i=1}^{n} X_{1i}X_{ki} \\ & & \sum_{i=1}^{n} X_{2i}^2 & \ddots & \sum_{i=1}^{n} X_{2i}X_{ki} \\ & & & \ddots & \vdots \\ & & & & \sum_{i=1}^{n} X_{ki}^2 \end{bmatrix}$$

$$X^T y = \begin{bmatrix} \sum_{i=1}^{n} y_i \\ \sum_{i=1}^{n} y_i X_{1i} \\ \sum_{i=1}^{n} y_i X_{2i} \\ \vdots \\ \sum_{i=1}^{n} y_i X_{ki} \end{bmatrix} \qquad y^T y = \sum_{i=1}^{n} y_i^2$$

$$\hat{\beta} = \left(X^T X\right)^{-1} X^T y \qquad s^2 = \frac{SSE}{n-k} = \frac{y^T y - \hat{\beta}^T X^T y}{n-k}$$

## Cantidades Importantes

$\sqrt{2} = 1.414$ $\sqrt{3} = 1.732$ $\sqrt{5} = 2.236$ $\sqrt{7} = 2.646$ $\sqrt{10} = 3.162$
$\sqrt{13} = 3.606$

## Valores críticos de la distribución t

| $n$ | $t_{0.01,n-2}$ |
|---|---|
| **120** | **2.357** |

## Regresión simple

$$\hat{\beta}_1 = \overline{y} - \hat{\beta}_2 \overline{x} \qquad \hat{\beta}_2 = \frac{\sum_{i=1}^{n}(x_i - \overline{x})(y_i - \overline{y})}{\sum_{i=1}^{n}(x_i - \overline{x})^2} = \frac{\sum_{i=1}^{n} y_i x_i - n\overline{yx}}{\sum_{i=1}^{n} x_i^2 - n\overline{x}^2}$$

$$s^2 = \frac{\sum_{i=1}^{n}(y_i - \hat{y}_i)^2}{n-2} = \frac{\sum_{i=1}^{n}\hat{\varepsilon}_i^2}{n-2}$$

$$Var\left[\hat{\beta}\right] = \begin{bmatrix} Var\left[\hat{\beta}_1\right] & Cov\left[\hat{\beta}_1, \hat{\beta}_2\right] \\ Cov\left[\hat{\beta}_1, \hat{\beta}_2\right] & Var\left[\hat{\beta}_2\right] \end{bmatrix} = \begin{bmatrix} \frac{\sum_{i=1}^{n} x_i^2}{n\sum_{i=1}^{n}(x_i - \overline{x})^2}\sigma^2 & \frac{-\overline{x}}{\sum_{i=1}^{n}(x_i - \overline{x})^2}\sigma^2 \\ \frac{-\overline{x}}{\sum_{i=1}^{n}(x_i - \overline{x})^2}\sigma^2 & \frac{1}{\sum_{i=1}^{n}(x_i - \overline{x})^2}\sigma^2 \end{bmatrix}$$

$$SSR = \sum_{i=1}^{n}(\hat{y}_i - \overline{y})^2 \quad SST = \sum_{i=1}^{n}(y_i - \overline{y})^2 \quad SSE = \sum_{i=1}^{n}(y_i - \hat{y}_i)^2$$

$$r^2 = \frac{SSR}{SST} \qquad \hat{\beta}_i \pm t_{\frac{\alpha}{2}, n-k} s_{\hat{\beta}_i} \qquad t = \frac{\hat{\beta}_i - c}{s_{\hat{\beta}_i}}$$

$$\hat{y} \pm t_{\alpha/2, n-2} s \sqrt{1 + \frac{1}{n} + \frac{(x_p - \overline{x})^2}{\sum_{i=1}^{n}(x_i - \overline{x})^2}}$$

$$\hat{y} \pm t_{\alpha/2, n-2} s \sqrt{\frac{1}{n} + \frac{(x_p - \overline{x})^2}{\sum_{i=1}^{n}(x_i - \overline{x})^2}}$$

## Regresión múltiple

$$X^T X = \begin{bmatrix} n & \sum_{i=1}^{n} X_{1i} & \sum_{i=1}^{n} X_{2i} & \cdots & \sum_{i=1}^{n} X_{ki} \\ & \sum_{i=1}^{n} X_{1i}^2 & \sum_{i=1}^{n} X_{1i} X_{2i} & \cdots & \sum_{i=1}^{n} X_{1i} X_{ki} \\ & & \sum_{i=1}^{n} X_{2i}^2 & \ddots & \sum_{i=1}^{n} X_{2i} X_{ki} \\ & & & \ddots & \vdots \\ & & & & \sum_{i=1}^{n} X_{ki}^2 \end{bmatrix}$$

$$X^T y = \begin{bmatrix} \sum_{i=1}^{n} y_i \\ \sum_{i=1}^{n} y_i X_{1i} \\ \sum_{i=1}^{n} y_i X_{2i} \\ \vdots \\ \sum_{i=1}^{n} y_i X_{ki} \end{bmatrix} \qquad y^T y = \sum_{i=1}^{n} y_i^2$$

$$\hat{\beta} = \left(X^T X\right)^{-1} X^T y \qquad s^2 = \frac{SSE}{n-k} = \frac{y^T y - \hat{\beta}^T X^T y}{n-k}$$

## Cantidades Importantes

$\sqrt{2} = 1.414$ $\sqrt{3} = 1.732$ $\sqrt{5} = 2.236$ $\sqrt{7} = 2.646$ $\sqrt{10} = 3.162$
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## Valores críticos de la distribución t

| $n$ | $t_{0.01,n-2}$ |
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