

# C7: Variables cualitativas

## Efecto Aditivo

- Diferencias de **intercepto** entre grupos  $\rightarrow \beta_0$  intercepto con  $X_2=0$   
 $\beta_0 + \beta_2$  intercepto con  $X_2=1$

$$\hat{Y} = \hat{\beta}_0 + \hat{\beta}_1 X_1 + \hat{\beta}_2 X_2 + \epsilon$$

$\beta_2$

$\rightarrow$  diferencia **promedio** del grupo 1 respecto del grupo 0, manteniendo el resto **constante**

$$E(Y|X_1=1, \text{control}) - E(Y|X_1=0, \text{control})$$

$\rightarrow$  desplazamiento del intercepto entre grupos

$\rightarrow$  efecto parcial  $X_2$  sobre  $Y$

$X_2$   $\rightarrow$  1 grupo que aparece en regresión

$\rightarrow$  0 grupo **referencia o base**  $\rightarrow$  no  $\Delta$  estadístico, pero sí para interceptar

se pueden incluir ambas categorías (mujer y hombre) pero **sin** <sup>(\*)</sup> **intercepto**

$$Y_i = \delta_1 X_{1i} + \delta_2 X_{2i} + \delta_3 X_{3i} + \epsilon_i$$

$$E(Y|H, X_1) = \delta_1 X_1 + \delta_3$$

$\rightarrow$  igual pendiente, pero interceptos diferentes. Antes  $\beta_0$  era el de la variable omitida

**DEMOSTRACIÓN SOBRE CATEGORÍA**

$E(Y|H, X_1) = \beta_0 + \beta_1 X_1$   $E(Y|M, X_1) = \beta_0 + \beta_1 X_1 + \beta_2$  **EFF.**

$Y_i = \delta_1 + \delta_2 X_1 + \delta_3 X_2 + \epsilon_i$

$E(Y|H, X_1) = (\delta_1 + \delta_2 X_1) + \delta_3$

$E(Y|M, X_1) = (\delta_1 + \delta_2 X_1) + \delta_3 + \delta_4$

$\rightarrow$  misma diferencia solo cambia categoría de referencia

$\delta_1 = \beta_0 + \beta_2$   $\delta_2 = \beta_1$   $\delta_3 = \beta_0$   $\delta_4 = \beta_2$

## CATEGORIAS MÚLTIPLES

si tengo q categorías, con **q-1** variables binarias

□ categoría excluida o base (referencia)

$\rightarrow$  las categorías se analizan respecto a la excluida

**Colapsar y agrupar**

$\rightarrow$  usando q avg grande y n pequeño

□ Permite comparar si quiero saber si combinaciones son distintas (y que no son cat. referencia)

## Efecto Interacción

$\rightarrow \Delta$  en pendiente

## INTERACCIONES entre variables binarias

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_1 X_2 + \beta_4 X_2 X_1 + \beta_5 X_1 X_2 X_1$$

$\rightarrow$  No cambia la pendiente

## INTERACCIÓN entre cuantitativas y cualitativa

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_1 X_2 + \beta_5 X_1 X_3 + \beta_6 X_2 X_3 + \beta_7 X_1 X_2 X_3$$

□ Diferencias en  $E(Y)$  entre  $X_2=0$  y  $X_2=1$

□ Diferencias en  $E(Y)$  entre  $X_1=0$  y  $X_1=1$

□ Diferencias en  $E(Y)$  entre  $X_3=0$  y  $X_3=1$

□ Diferencias en  $E(Y)$  entre  $X_1=0$  y  $X_1=1$

□ Diferencias en  $E(Y)$  entre  $X_2=0$  y  $X_2=1$

□ Diferencias en  $E(Y)$  entre  $X_3=0$  y  $X_3=1$

□ Diferencias en  $E(Y)$  entre  $X_1=0$  y  $X_1=1$

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## Modelo sencillo

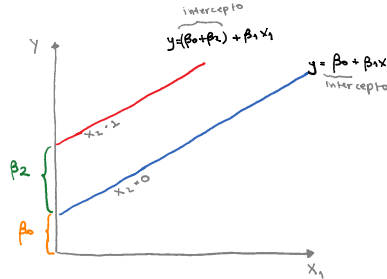
$$\text{salario} = \beta_0 + \beta_1 \text{mujer} + \beta_2 \text{edu} + u$$

$$\text{mujer} = 1 \text{ (si } \varnothing \text{)} \quad \text{mujer} = 0 \text{ (si } \sigma^7 \text{)}$$

$\rightarrow$  TRAMPA DE VARIABLES DUMMY  
 \* multicolinealidad perfecta (\*)

¿Qué pasa si tengo intercepto?

$\rightarrow$  colinealidad perfecta una variable es combinación lineal de variables



## 1.1 INFERENCIA

¿Diferencias de los grupos a nivel poblacional?

$$H_0: \beta_2 = 0 \quad H_1: \beta_2 > 0$$

$\rightarrow$  prueba t

$$H_0: \delta_3 = \delta_2 \quad H_1: \delta_3 \neq \delta_2$$

$\rightarrow$  prueba F (combinación R)

$\rightarrow$  requiero matriz cov-var

Ejemplo

civil-sexo

M = mujer  
H = hombre  
C = casado  
S = soltero

reg salario 1. genero-casado

ibz  
 $\downarrow$   
 grupo base 2

$$\ln(\text{salario}) = 0.321 + 0.213 H-C - 0.198 M-C - 0.111 S+... +$$

$$0.213 \times 100\% \rightarrow H-C \text{ tienen un salario } 21.3\% \text{ mayor que } H-S$$

□ Diferencia salarial mujeres

$$[M-C - M-S] = -0.198 - (-0.111)$$

$$= -0.08 \rightarrow -8.8\%$$

$$M-C \text{ ganan } 8.8\% \text{ menos que } M-S$$

$$\ln(\text{salario}) = 0.321 + 0.111 M + 0.213 C - 0.111 M-C$$

$$\Delta \ln(\text{salario}) = 0.213 + (-0.111) \cdot C$$

$$= 0.213 - 0.08 = 0.133$$

$$= 13.3\%$$

TEST DE SI SE SIGUE = MODELOS

reg Y 1. fem \*\*\* C var 1

test 1. female \*\*\* C var 2

\*  $\beta_0 \rightarrow$  "en promedio"

\*  $\beta_j \rightarrow$  "de pendiente" de cada variable

Modelo no restringido

$$Y = \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \beta_3 X_3 + \beta_4 X_4 + \beta_5 X_5 + \beta_6 X_6 + \beta_7 X_7 + \beta_8 X_8 + \beta_9 X_9 + \beta_{10} X_{10} + \beta_{11} X_{11} + \beta_{12} X_{12} + \beta_{13} X_{13} + \beta_{14} X_{14} + \beta_{15} X_{15} + \beta_{16} X_{16} + \beta_{17} X_{17} + \beta_{18} X_{18} + \beta_{19} X_{19} + \beta_{20} X_{20} + \beta_{21} X_{21} + \beta_{22} X_{22} + \beta_{23} X_{23} + \beta_{24} X_{24} + \beta_{25} X_{25} + \beta_{26} X_{26} + \beta_{27} X_{27} + \beta_{28} X_{28} + \beta_{29} X_{29} + \beta_{30} X_{30} + \beta_{31} X_{31} + \beta_{32} X_{32} + \beta_{33} X_{33} + \beta_{34} X_{34} + \beta_{35} X_{35} + \beta_{36} X_{36} + \beta_{37} X_{37} + \beta_{38} X_{38} + \beta_{39} X_{39} + \beta_{40} X_{40} + \beta_{41} X_{41} + \beta_{42} X_{42} + \beta_{43} X_{43} + \beta_{44} X_{44} + \beta_{45} X_{45} + \beta_{46} X_{46} + \beta_{47} X_{47} + \beta_{48} X_{48} + \beta_{49} X_{49} + \beta_{50} X_{50} + \beta_{51} X_{51} + \beta_{52} X_{52} 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X_{102} + \beta_{103} X_{103} + \beta_{104} X_{104} + \beta_{105} X_{105} + \beta_{106} X_{106} + \beta_{107} X_{107} + \beta_{108} X_{108} + \beta_{109} X_{109} + \beta_{110} X_{110} + \beta_{111} X_{111} + \beta_{112} X_{112} + \beta_{113} X_{113} + \beta_{114} X_{114} + \beta_{115} X_{115} + \beta_{116} X_{116} + \beta_{117} X_{117} + \beta_{118} X_{118} + \beta_{119} X_{119} + \beta_{120} X_{120} + \beta_{121} X_{121} + \beta_{122} X_{122} + \beta_{123} X_{123} + \beta_{124} X_{124} + \beta_{125} X_{125} + \beta_{126} X_{126} + \beta_{127} X_{127} + \beta_{128} X_{128} + \beta_{129} X_{129} + \beta_{130} X_{130} + \beta_{131} X_{131} + \beta_{132} X_{132} + \beta_{133} X_{133} + \beta_{134} X_{134} + \beta_{135} X_{135} + \beta_{136} X_{136} + \beta_{137} X_{137} + \beta_{138} X_{138} + \beta_{139} X_{139} + \beta_{140} X_{140} + \beta_{141} X_{141} + \beta_{142} X_{142} + \beta_{143} X_{143} + \beta_{144} X_{144} + \beta_{145} X_{145} + \beta_{146} X_{146} + \beta_{147} X_{147} + 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$$SSR_{\text{un}} = 1 \quad (G-1)(K+1)$$

$$H_0 = \begin{cases} \alpha_1 = \alpha_2 = \alpha_3 \\ \beta_{1,1} = \beta_{1,2} = \beta_1 \\ \beta_{2,1} = \beta_{2,2} = \beta_2 \end{cases}$$

\* Puede determinar si un set de datos puede ser unido?  $\rightarrow$  varianza de residuos

Chow test is simply a test of whether the coefficients estimated over one group of the data are equal to the coefficients estimates over another