duda ¿ porqué transformad lineal corrige heteroscedasticidad?

- with large samples isn't important eficiency

Heteroskedasticity

- No relation with unbiased $E(\hat{\beta})$ and consistency $Var(\hat{\beta})$ → tiene que ver con varianza de residuos
- No relation with fit (R^2) MLR1 - MLR4
- Related to simple size — asymptotical analysis

Standar errors (se) to estimate t & F distribution

DEF : constant variance MLR5

$$Var(u \mid x_1, x_2, \dots, x_k) = \sigma^2 I_n$$

important to INFERENCE

(2) MELI (MLR1-MLR5) (best linear unbiased estimator)
OLS is no longer asymptotically eficient but unbiased.

(1) HYPOTHESIS under Gauss Markow assumptions

(1) TEST

OPTION 1 – BREUSH PAGAN → heterocedasticidad lineal

H_0 : $Var(u \mid x_1, x_2, \dots, x_k) = \sigma^2$ (test MLR5) ⟶ $H_0 : \delta_1 = \delta_2 = \dots = \delta_k = 0$

Probaremos si u^2 está relacionado con alguna de las variables independientes

$Var(u \mid X)$ by MLR1-4

$E(u^2 \mid x) = \sigma^2 = E(u^2)$

(1) Regresión lineal de residuos y regresores

$$\hat{u}^2 = \delta_0 + \delta_1 x_1 + \delta_2 x_2 + \dots + \delta_k x_k + \text{errores}$$

(2) Hipótesis conjunta

$$F = \frac{R^2_{\hat{u}^2}}{(1 - R^2_{\hat{u}^2})} \cdot \frac{(n-k-1)}{k}$$

OPTION 2 : WHITE TEST → heterocedasticidad no lineal

Probaremos si u^2 está relacionado con todas las variables

(1) Regresión lineal de residuos y regresores

$$\hat{u}^2 = \delta_0 + \delta_1 x_1 + \delta_2 x_2 + \dots + \delta_k x_k + \text{errores}$$
$$\delta_3 x_1^2 + \delta_4 x_1 x_2 + \dots + \delta_{k^2} x_k^2$$

(2) Hipótesis conjunta

$$F = \frac{R^2_{\hat{u}^2}}{(1 - R^2_{\hat{u}^2})} \cdot \frac{(n-k-1)}{k}$$

Con k grande y n pequeño

↓ Alternativa pues → K restricciones son más entre más variables sean

Ejemplo
Si tengo 3 variables en MRL ⟶ son 9 restricciones (interacc. de x_1, x_2 y x_3)
Si tengo 6 variables ⟶ 27 restricciones
6 variables ⟶ 27 regresore
→ Necesitaré más grados de libertad para estimar $\hat{u}^2$

Paso 1 Regreso $\hat{y}_i$

$$\hat{y}_i = \hat{\beta}_0 + \hat{\beta}_1 x_{i1} + \hat{\beta}_2 x_{i2} + \dots + \hat{\beta}_k x_{ik}$$

Paso 2 Tomo $\hat{y}_i^2$ y es predictor de $\hat{u}^2$

$$\hat{u}^2 = \delta_0 + \delta_1 \hat{y} + \delta_2 \hat{y}^2 + \text{error}$$

Paso 3 Pruebo hipótesis $H_0 : \delta_1 = \delta_2$

(2) SOLUTIONS

ROBUST INFERENCE

- Estimation in prescence of heteroskedasticity → corregir SE
- Asymptotical Approach ($n \to \infty$)

in presence of multicollinearity we test RI

RLS

$$y_i = \beta_0 + \beta_1 x_i + u_i$$

Heteroskedasticity $Var(u_i \mid x_i) = \sigma_i^2$ } σ_i^2 cambia cuando cambia i

Con homocedasticidad $\sigma_i^2 = \sigma^2$

$$Var(\hat{\beta}_1 \mid x_i) = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sigma^2}{\left[\sum_{i=1}^{n}(x_i-\bar{x})^2\right]^2} = \frac{\sigma^2 \sum_{i=1}^{n}(x_i-\bar{x})^2}{\left[\sum_{i=1}^{n}(x_i-\bar{x})^2\right]^2} = \frac{\sigma^2}{\sum_{i=1}^{n}(x_i-\bar{x})^2}$$

SSR$_x^2$

Con heteroskedasticity

$$Var(\hat{\beta}_1 \mid x_i) = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2 \sigma_i^2}{\left[\sum_{i=1}^{n}(x_i-\bar{x})^2\right]^2}$$

SSR$_x^2$

ROBUST STANDARD ERRORS (WHE SE)

Tomando (1) o (2)

R.L.S

$$Var(\hat{\beta}_1 \mid x_i) = \frac{\sum_{i=1}^{n}(x_i - \bar{x})^2 \hat{u}_i^2}{\left[\sum_{i=1}^{n}(x_i-\bar{x})^2\right]^2}$$

$$se = \sqrt{Var(\beta_j \mid x)}$$

o R.L.M

$$Var(\hat{\beta}_j \mid x) = \frac{\sum_{i=1}^{n} \hat{r}_{ij}^2 \hat{u}_i^2}{\left[\sum_{i=1}^{n} \hat{r}_{ij}^2\right]^2}$$

$\hat{r}_{ij}^2$ = residuos iesimo de regresar x_i en cada x_j (correlación)

es de residuos SCR_j^2 ⟶ $SCT_j \cdot (1 - R_j^2)$

SE ROBUST → t = estimación – valor hipotético / error estandar robusto

Solo válidos asintoticamente

SE are more valid ?
Why compute normal SE.
→ If homocedasticity is valid, se ~ N, and t & F have exactly distributions independent of the size sample
→ Robust SE in high sample
Si no es una aproximación.

Empirical regularities

1. If "normal" estimations are significant, probably in robust estimation to.
2. In general Robust SE > Normal SE ---> In homocedasticity, estimators are minimum (No siempre)
3. Robust SE ≈ Normal SE in homoceskdasticity

- Los β no cambian, solo SE

B LM TEST (H_0: homoskedasticity)

STEP 1. ESTIMATE MLR AND SAVE RESIDUALS, COMPUTE $\hat{u}^2$ (SQUARED RESIDUALS)

errors are inobservables

STEP 2. ESTIMATE AUXILIAR REGRESSION WITH PREDICTORS (OF RESIDUALS)

$$\hat{u}_{2_{NR}} = \delta_0 + \delta_1 \cdot x_1 + \dots + \delta_k x_k + \text{error}$$

(repeat with restricted model)

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STEP 3. COMPUTE LM (or F) TEST

$$ML = \frac{R^2_{\hat{u}_{NR}} - R^2_{\hat{u}_R}}{(1 - R^2_{\hat{u}_{NR}})} \cdot \frac{(n-k-1)}{q} \xrightarrow{\text{i.i.d } a} F_{(q, n-k-1)}$$

"asymptotical" ⟶ solo válido asintóticamente

Global

$$n \cdot R^2_{\hat{u}} \xrightarrow{a} \chi^2_K$$

CHISQ-TEST

⟶ $ML \approx \chi^2_K$ are similar when $n \to \infty$