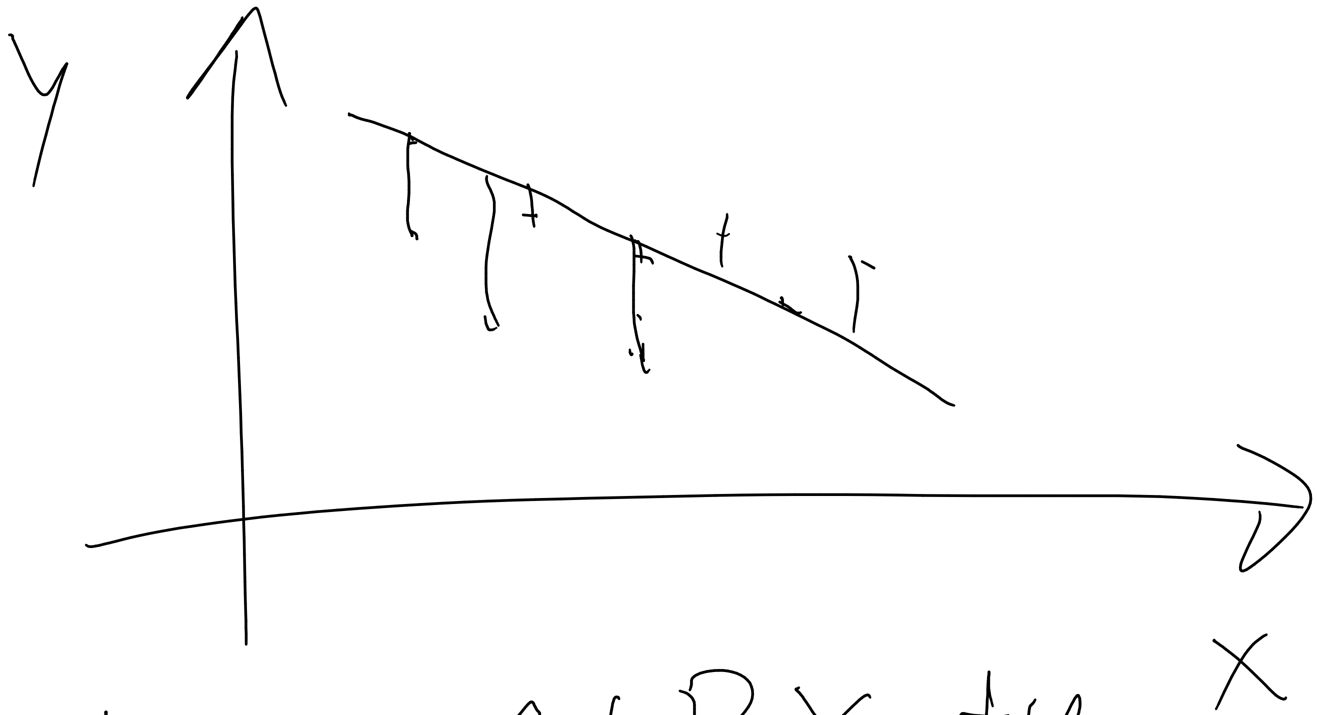
REGRESSIONE LINEARE:



$$y_t = \alpha + \beta X_t + \underbrace{u_t}_{\text{errore}}$$

$$y = \hat{\alpha} + \hat{\beta} x$$

$$\min_{\alpha,\beta} \sum \left(y - \hat{y}\right)^2 = L$$

$$\sum \left(y - \overbrace{\hat{\alpha} - \hat{\beta} x}\right)^2$$

$$\frac{\partial L}{\partial \alpha} = 0 \qquad \frac{\partial L}{\partial \beta} = 0$$

$$\hat{\alpha} = \bar{y} - \hat{\beta} \cdot \bar{x}$$

$$\hat{\beta} = \frac{\sum (x_t - \bar{x}) \cdot (y_t - \bar{y})}{\sum (x_t - \bar{x})^2}$$

1) $E(u_t) = 0$

2) $VAR(u_t) = \sigma^2 < \infty$

3) $cov(u_i, u_j) = 0$

4) $cov(x_t, u_t) = 0$

$\hat{\alpha}$, $\hat{\beta}$

B.L.U.E. → estimator
unbiased
↓ Best linear
↓
min. VARIANZA

$E(\hat{\alpha}) = \alpha$

$E(\hat{\beta}) = \beta$

$$\text{STD error}(\alpha) = \sqrt{\frac{\sum x_t^2}{T \cdot \sum (x_t - \bar{x})^2}} \cdot s$$

T = N° OSSERVAZ

$$\text{STD error}(\beta) = \sqrt{\frac{1}{\sum (x_t - \bar{x})^2}} \cdot s$$

$$s = \sqrt{\frac{\sum u_t^2}{T-2}} = \text{std error della regressione}$$

+ basso meglio

+ Hp errori sono distribuiti come una NORMALE

$$\alpha \sim N\left(\alpha, \operatorname{var}(\alpha)\right)$$

$$\beta \sim N\left(\beta, \operatorname{var}(\beta)\right)$$

Test Hp)

H_0 = ipotesi nulla

$\boxed{\beta = 0}$

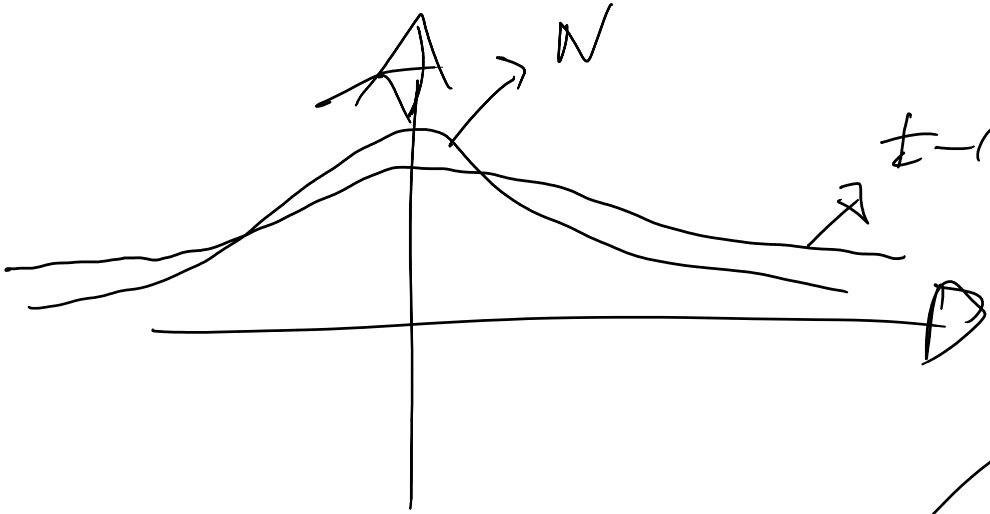
$$\frac{\hat{\beta} - 0}{\text{std error}(\hat{\beta})} = t_{STAT}$$

$\beta \neq 0$ alternativa

$$\frac{\hat{\beta} - 0}{\text{STD err}(\beta)} \sim t_{T-2}$$

T: N° osservaz

2: $\hat{\alpha}, \hat{\beta}$ — 2 PARAM

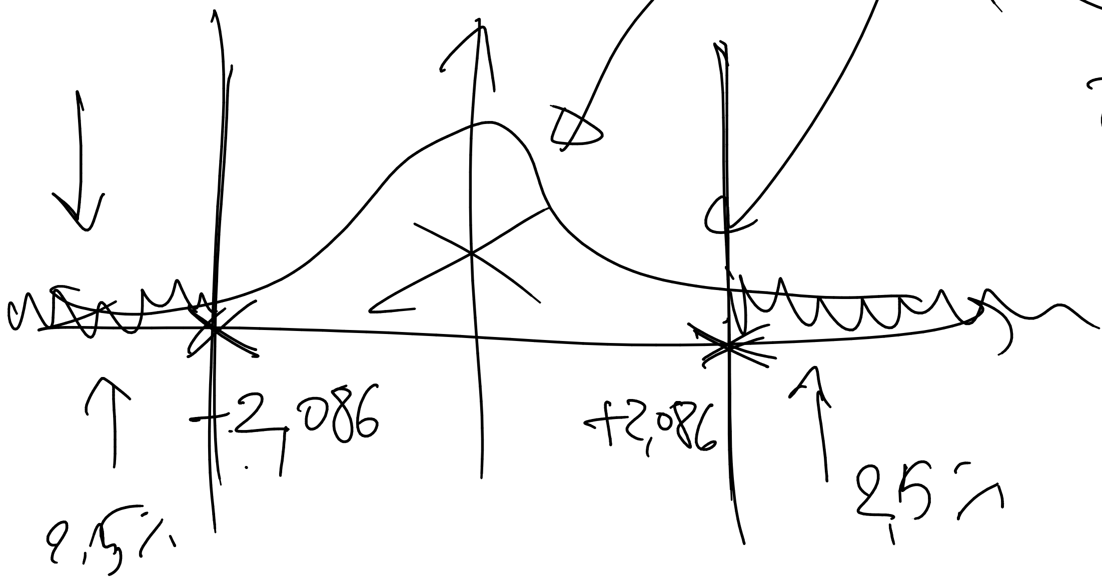


t-student

$$t = \frac{\beta - 0}{stderr(\beta)} = 1,06$$

$t_{20\ grados}$
lib

5%



MISURE DI BONTÀ DELLA
regressione =

1) $\underline{R^2}$

2) F-stat della regressione

$$R^2 = \left[\text{correlaz}(x, y)\right]^2$$

coeff

$$0 < R^2 < 1$$

+ R^2 si avvicina a 1 migliore rapp.

$$T.S.S. = \sum \left[y_t - \bar{y}\right]^2$$

TOTAL SUM OF SQUARES

$$TSS = ESS + RSS$$

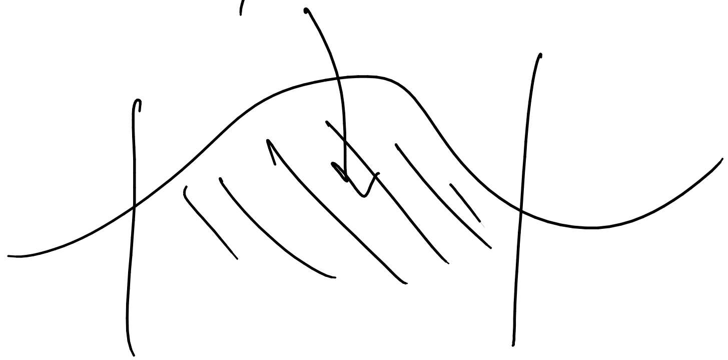
explained residual

$$\sum (y_t - \bar{y})^2 = \underbrace{\sum [\hat{y}_t - \bar{y}]^2}_{} + \sum [y_t - \hat{y}_t]^2$$

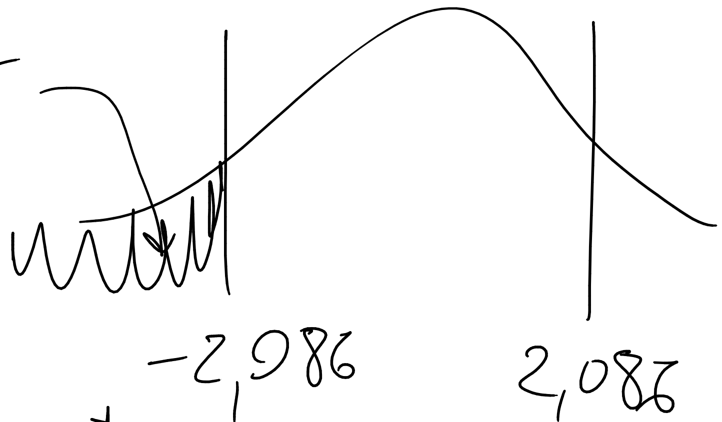
$$\sum \hat{u}^2_t$$

$$R^2 = \frac{ESS}{TSS} = 1 - \frac{RSS}{TSS}$$

se $t = 1,06$ NON RIFIUTO $\underline{H_0}$



se $t = -3,05$



RIFIUTO H_0

$\beta \neq 0$ STATISTICAMENTE significativo

F-stat della regressione:

F_{STAT} = test H_0 che tutti i

parametri $\beta = 0$

$$y = \alpha + \beta_1 x_1 + \beta_2 x_2 + \dots + \beta_m x_m$$

$$F_{stat} = \frac{R^2 (T-k)}{1-R^2 (k-1)}$$

legame con R^2 della statistica

F

N° osservazioni

Distribuzione $F_{m,\, T-K}$ → N° param stimati

N° di restrizioni $B = 0$ → 1

$B_1 = 0 \quad B_2 = 0$ → 2 restriz.

ex $\alpha + \beta x = y$

$T = 20$ osservaz

$k = \alpha, \beta$

$F_{(1, T-2)}$

F testa $\beta = 0$

$\alpha + \beta_1 x_1 + \beta_2 x_2$

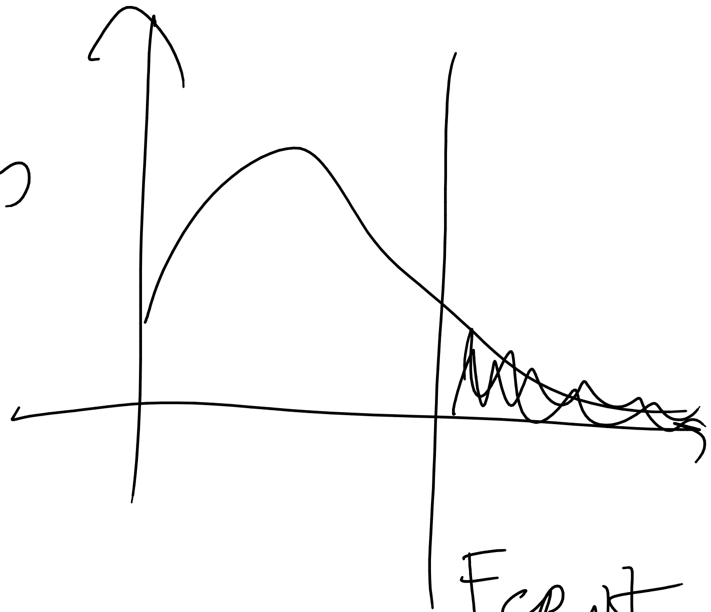
$F_{(2, T-3)}$

F testa

$$\begin{cases} \beta_1 = 0 \\ \beta_2 = 0 \end{cases}$$

F

distrib



Fcrit

F > Fcrit

rifiuto

Excel :

Test di ipotesi =

= INV.T.2T (0,05 ; GRADI DI LIBERTÀ)

= INV.F.DS (0,05 ; m ; T-k)

$$=\text{REGR.LIN}(y; X; ; \text{Vero})$$

Falso

$$y = \alpha + \beta X$$

β	α
$\hat{\beta}$	$\hat{\alpha}$
STD error β	std error α
R^2	s
F	Gradi libertà
ESS	RSS

STD error regressione

$\beta = 0$

$T-K$

$= \text{intercetta}(y\,;\,x) \Rightarrow \alpha$

$= \text{pendenza}(y\,;\,x) \Rightarrow \beta$

$= \text{RQ}(y\,;\,x) \Rightarrow R^2$