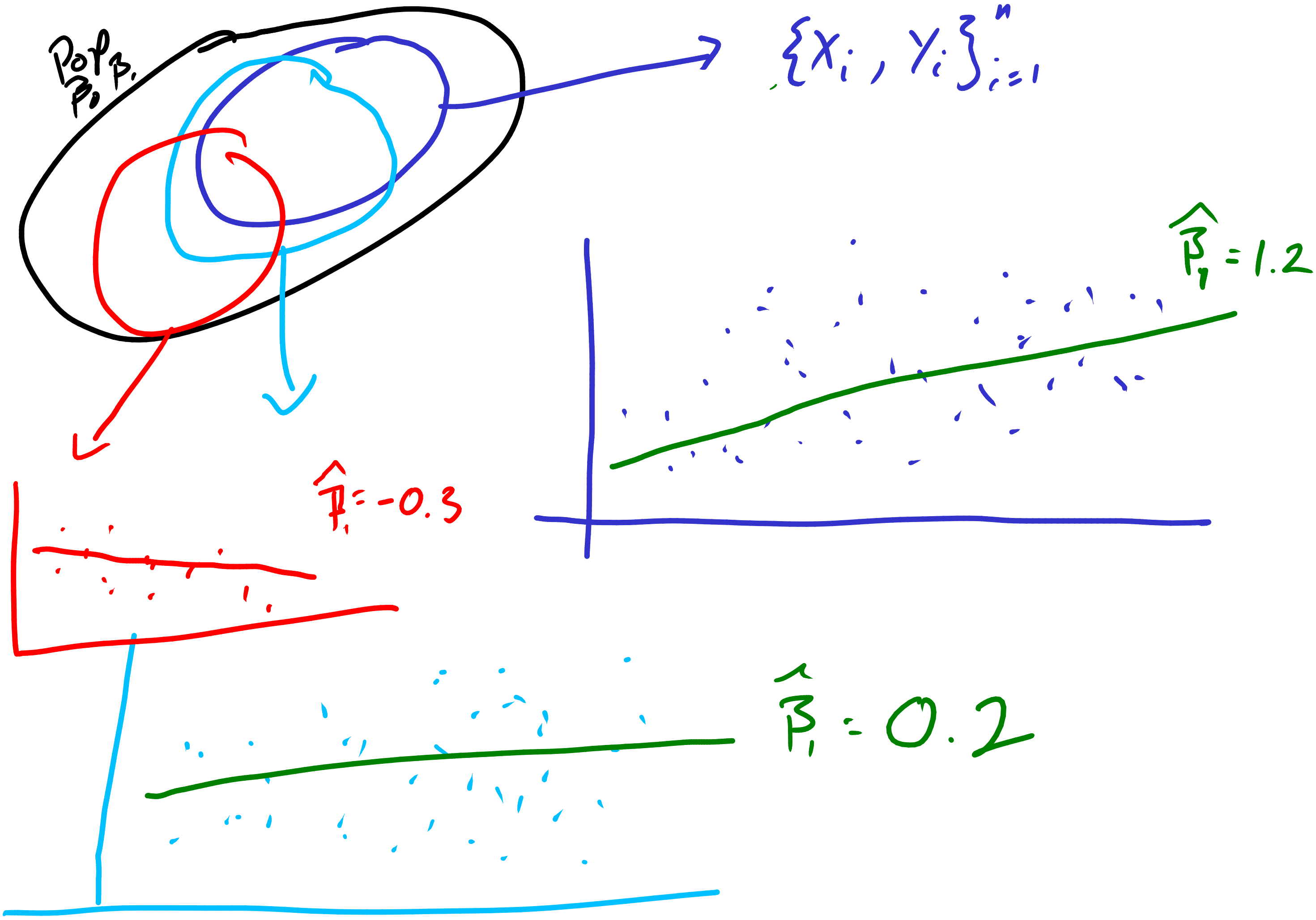
May 15 10:30 - 12:30

Final

Hypothesis Testing



Is there a linear relationship?

No Relationship $\beta_1 = 0$

Yes Relationship $\beta_1 \neq 0$

$\hat{\beta}_1 = 1.2 \pm 0.25$

Hypothesis testing.

Testing 2 claims to see which has significant difference Results.

Linear Regression $\beta_1 = ?$

Null Hypothesis

Something we believe to be true. No difference No association.

$\beta_1 = 0$

Alternative Hypothesis.

Opposite of Null Hypothesis.

$\beta_1 \neq 0$

Testing the Null Hypothesis.

$$\hat{\beta}_1 \sim N(\beta_1, SE(\hat{\beta}_1))$$

$$\underbrace{\frac{\hat{\beta}_1}{SE(\hat{\beta}_1)}} \sim N(0, 1)$$

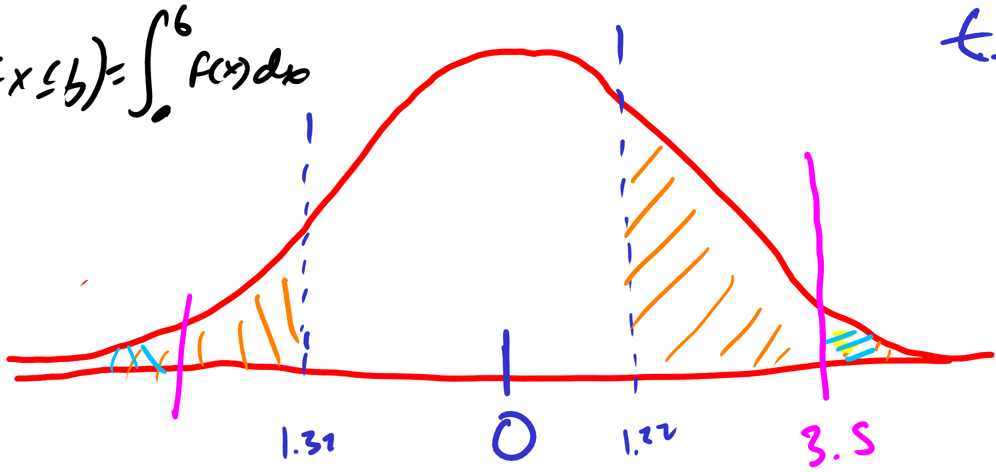
$\beta_1 = 0$

$P(a \le x \le b) = \int_a^b f(x)\,dx$

$ts = \dfrac{\hat{\beta}_1}{SE(\hat{\beta}_1)}$ 1.?

$= 1.32$

$ts = 3.5$



$2\int_{1.32}^{\infty} N(0,1)\,dx$

0.24

$\int_{3.5}^{\infty} N(0,1)\,dx$

0.001

$$2 \cdot P\left(ts > \left|\frac{\hat{\beta}_1}{SE(\hat{\beta}_1)}\right|\right) = p\text{-value}$$

The probability of observing your test statistic or something more extreme given your null hypothesis.

$H_0: \beta_1 = 0$ $\qquad$ $H_a: \beta_1 \neq 0$

null $\qquad$ alt.

$\alpha = 0.05$

$\alpha < p$ $\qquad$ $p = 0.065$

Fail to Reject H_0

$\alpha = 0.1$

$\alpha > p$

Reject H_0

α = significance level Probability of Rejecting your null hypothesis given that it is true.

There is a significant Relationship w/ data

There is no sig. relationship b/w x and y

$H_0: \beta_1 = 0$ $\quad$ $H_a: \beta_1 \neq 0$

$<$

$>$

$p = k$ $\quad$ $\alpha = 0.05$

$p < \alpha$
Reject H_0

$p > \alpha$
Fail to Reject H_0

There is a sig relationship b/w x and y ($p = k$)

There is not a sig relationship b/w x and y ($p = k$)

Confidence Interval Approach

Construct an Interval of numbers.

$H_0: \beta = \beta^*$ $\quad$ $H_a: \beta \neq \beta^*$

$$PE \pm CV \; SE$$

Point Estimate

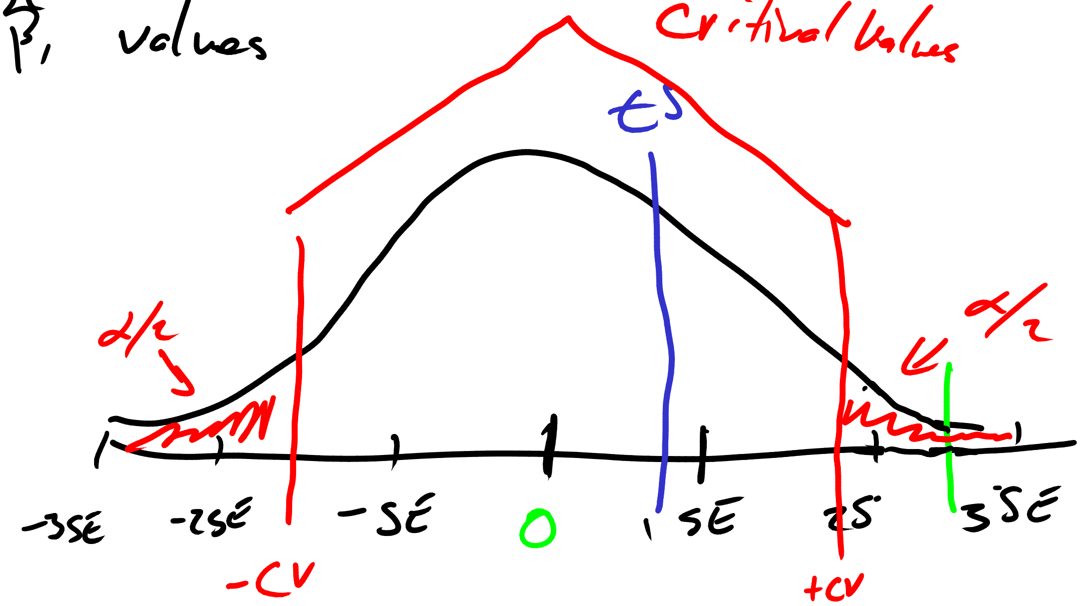
$\hat{\beta}$

Critical Value

Distance from zero

SE

This provides a pseudo-range of potential $\hat{\beta}_1$ values



$(1-\alpha)100\%$ CI

$$PE \pm CV_{\alpha/2}\, SE$$

$(LB = PE - CV \cdot SE,\ UB = PE + CV \cdot SE)$

$(-5,\ -4)$ $\quad \beta^* = 0$

$(LB,\ UB)$

$H_0: \beta_1 = \beta^*$ $\quad H_a: \beta_1 \neq \beta^*$

$\beta^* \in (LB, UB)$

Fail to Reject Ho

$\beta^* \notin (LB, UB)$

Reject Ho