POLS 309: Hypothesis Testing

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Crafting Hypotheses

- When we craft our hypotheses in political science, we often have some criteria we consider desirable for a good hypothesis:
  - Directionality ($\uparrow X \rightarrow \uparrow Y$ or $\uparrow X \rightarrow \downarrow Y$)
  - Causality (our theory normally is a logical, plausible, falsifiable explanation of how x should cause y)

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- We define our hypotheses this way so that they are exclusive and exhaustive (i.e. there is no third option, only one of these can be true)

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    Vote $\text{Choice}_{it} = \alpha + \beta_1 \text{Economic Perception}_{it} + \varepsilon$
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  - This is equivalent to setting $\beta_1 = 0$, we are saying deterministically economic perception's effect on vote choice is non-existent

Restricted vs Unrestricted Hypothesis Test

- Whenever we test our null hypotheses, we are effectively testing if imposing this restriction of $\beta = 0$ is an appropriate restriction OR should we let β be free and allowed to vary
- When our *p*-value is lower than some threshold, α, we reject that this restriction is appropriate and we say: let this parameter β vary.
- When test our theories, what this means for us is that we are testing: "is making the assumption that our regressor β has no effect, a safe bet?"
    - That is why we **do not** want to prove our null, we *want* to find evidence against it because a causal and directional theory about β means we want β to influence how Y changes

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  - N.B. As $N \rightarrow \infty$, $t \rightarrow z$.

t-tests

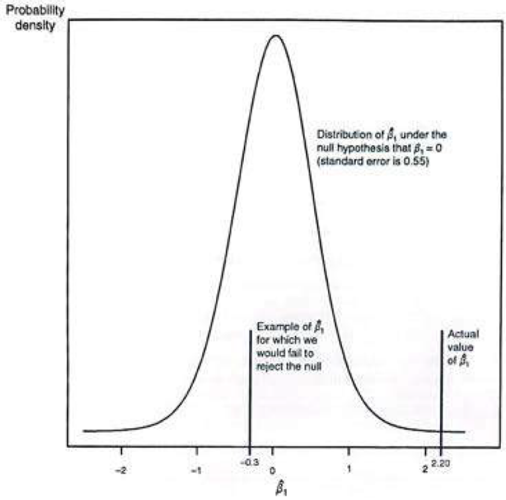

Figure: Distribution of $\hat{\beta}$ under a null hypothesis (p.99 Bailey 2021)

p-values

- Now that we have our null hypothesis and our test statistic/distribution, we just need a significance level or α
- Our value of α determines the cut-off at which point we say, observing this value in our distribution is probabilistically, pretty unlikely
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- By definition, our t-statistic's distribution is normal-ish (with higher kurtosis) and our estimated β is in the tails, that means our estimated β is really unlikely to have occurred.
- So β is unlikely to have really come from this t-distribution, meaning it is really unlikely β is 0.

Quick Review

General Steps for Hypothesis Testing

- Choose a null hypothesis H_0 and alternative H_A
- Choose a test statistic and its corresponding distribution (e.g. t-test)
- Choose your significance level α
- Determine your rejection region (one-tailed or two-tailed test)
- Calculate the test statistic ($t = \frac{\beta}{SE(\beta)}$)
- Reject H_0 if test statistic falls in rejection region