Conditions for a Simple Linear Model

READING:	1.2
EXERCISES:	NONE
ASSIGNED:	HW 2
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IMG CREDIT: [ALEX RIEGERT-WATERS]

Simple Linear Regression Model

- Model:

$$Y = \beta_0 + \beta_1 X + \epsilon$$

- Will Not Fit Perfectly, But is It Reasonable
- Goal of Model could be **Description** or **Inference**

Condition About Model Form

- **Linearity:** *Assume that Y varies as a linear function of X*

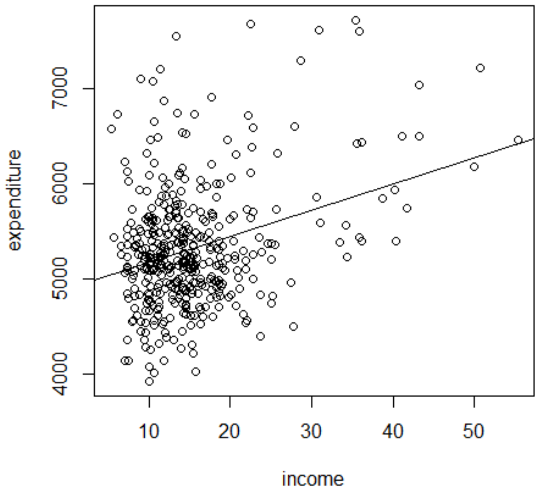
- Advice: *Always supplement your simple linear regressions with a scatterplot showing your audience the line fitted to the raw data*

```
library(AER) #Package for Applied Econometrics Textbook

data("CASchools") #Puts dataset into Global Environment

mod1=lm(expenditure~income, data=CASchools)

plot(expenditure~income,data=CASchools)
abline(mod1)
```



Conditions About Distribution of Errors

- **Zero Mean:** *The distribution of errors is centered at 0*
- **Uniform Spread:** *The variance of Y is the same for each X (Homoscedasticity)*
- **Independence:** *No relationships exist between errors*

Conditions Necessary for Inference

- **Normality:** *Assume that the errors follow a normal distribution*

- **Randomness:** *Simple random sample that is representative of the population we are trying to study*

Restatement of Model

$$Y = \beta_0 + \beta_1 X + \epsilon$$

$$\epsilon \overset{iid}{\sim} Normal(0, \sigma_\epsilon)$$

$iid =$ *"Independent and Identically Distributed"*

Standard Error of Regression

- The Parameter σ_ϵ Represents Standard Deviation of the Errors Around the Linear Regression Line

- **Standard Error of Regression** $\hat{\sigma}_\epsilon$: Represents the "Typical" Error

$$\hat{\sigma}_\epsilon = \sqrt{\frac{\sum(y-\hat{y})^2}{n-2}} = \sqrt{\frac{SSE}{n-2}} = \sqrt{\frac{SSE}{degrees\ of\ freedom}}$$

- **Degrees of Freedom:** Sample Size Minus Number of Parameters

- Recall Formula for Standard Deviation (Divide by *n-1*)

Thank You

Make Reasonable Decisions