
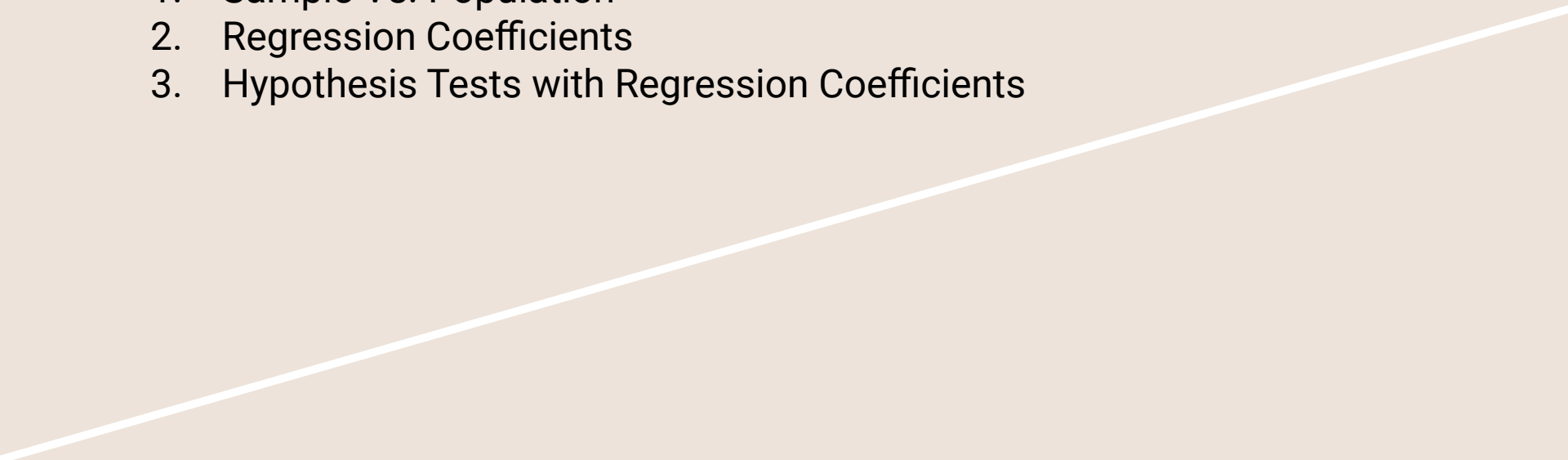


Hypothesis Testing In Regression

A dark blue diagonal gradient bar that starts from the bottom left and extends towards the top right, covering the lower half of the slide.

Agenda

1. Sample Vs. Population
 2. Regression Coefficients
 3. Hypothesis Tests with Regression Coefficients
- 

Samples & The Population



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Parameter - Numerical Characteristic of a Population

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- Mean - μ
- Standard Deviation - σ

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Statistics are **ESTIMATES** of Parameters

Samples & The Population

Car Example

Samples & The Population

Car Example

2020 Cars Data (418 cars) Means			
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Population (μ)	418	24.17	4.408

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What about the relationship between MPG & Weight?

Regression Coefficients

Recall our model:

$$y = \beta_0 + \beta_1 x_1 + \varepsilon$$

$$y = \text{MPG}$$

$$x_1 = \text{Weight}$$

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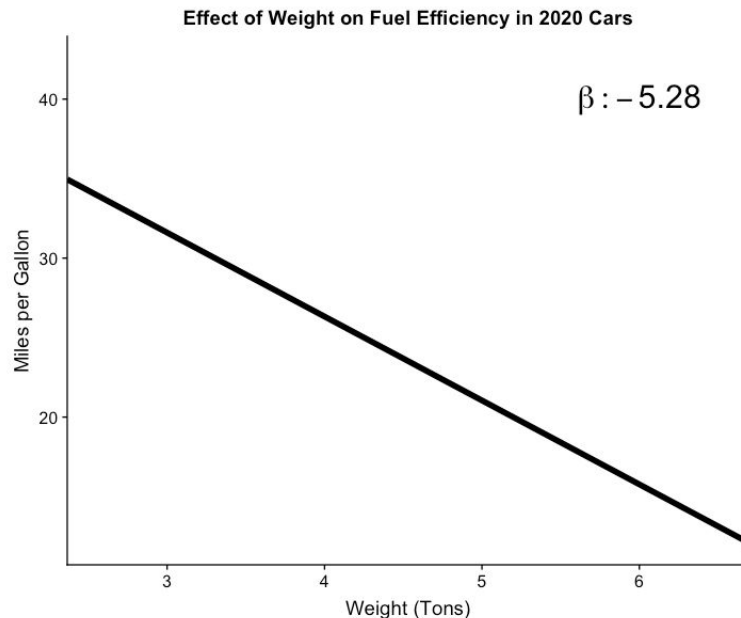
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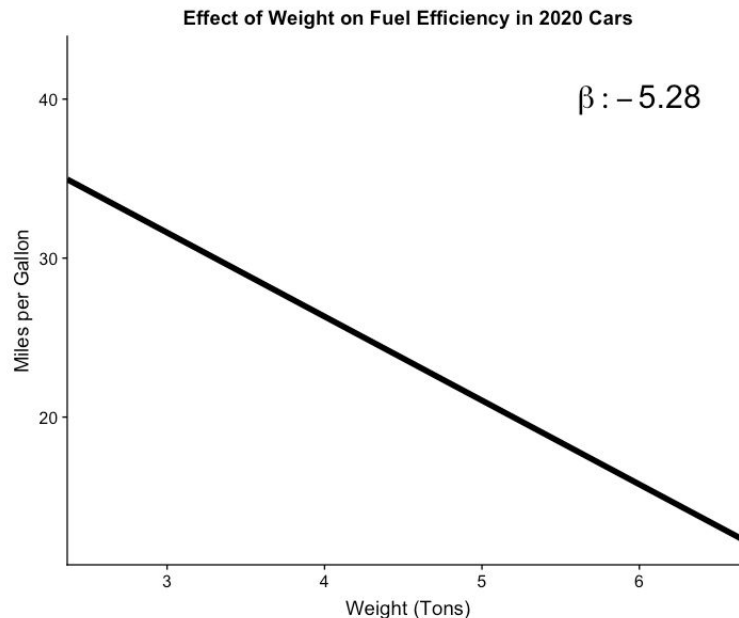
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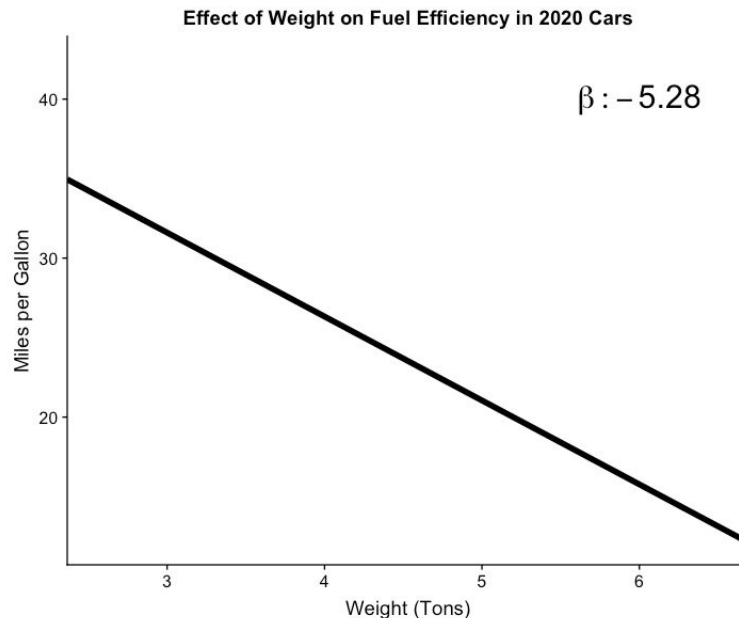
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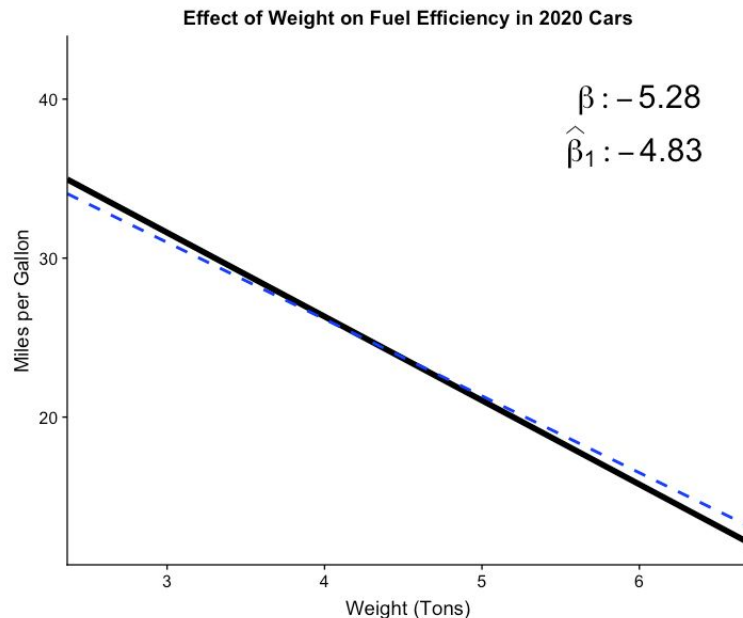
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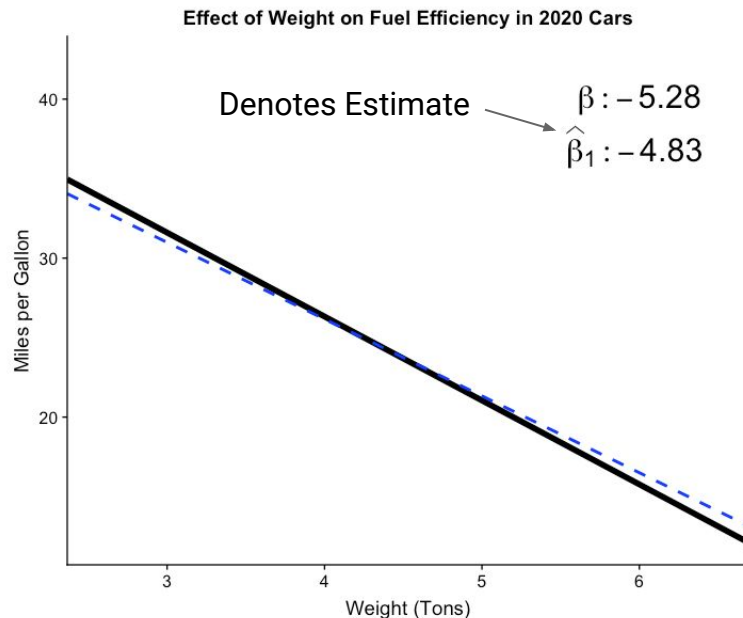
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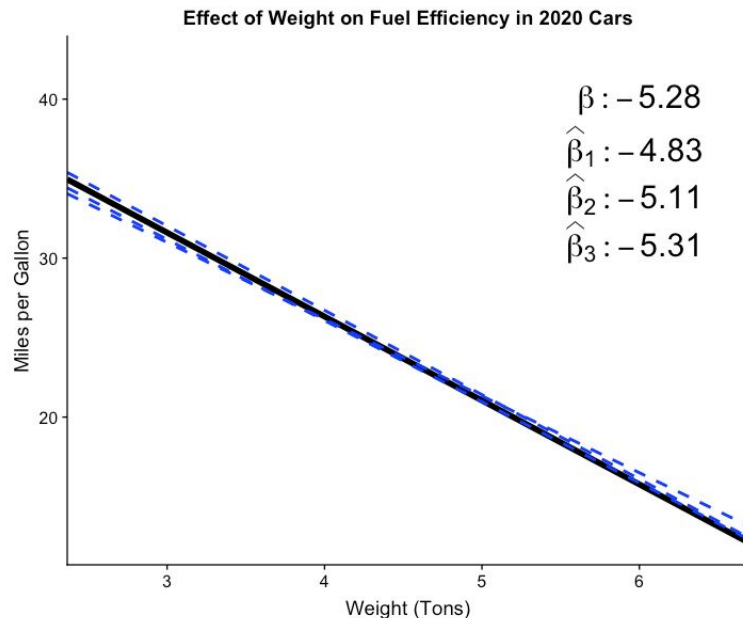
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Sample 3	100	24.67	4.39	-5.31



Regression Coefficients

Regression Coefficient for Weight (Tons)

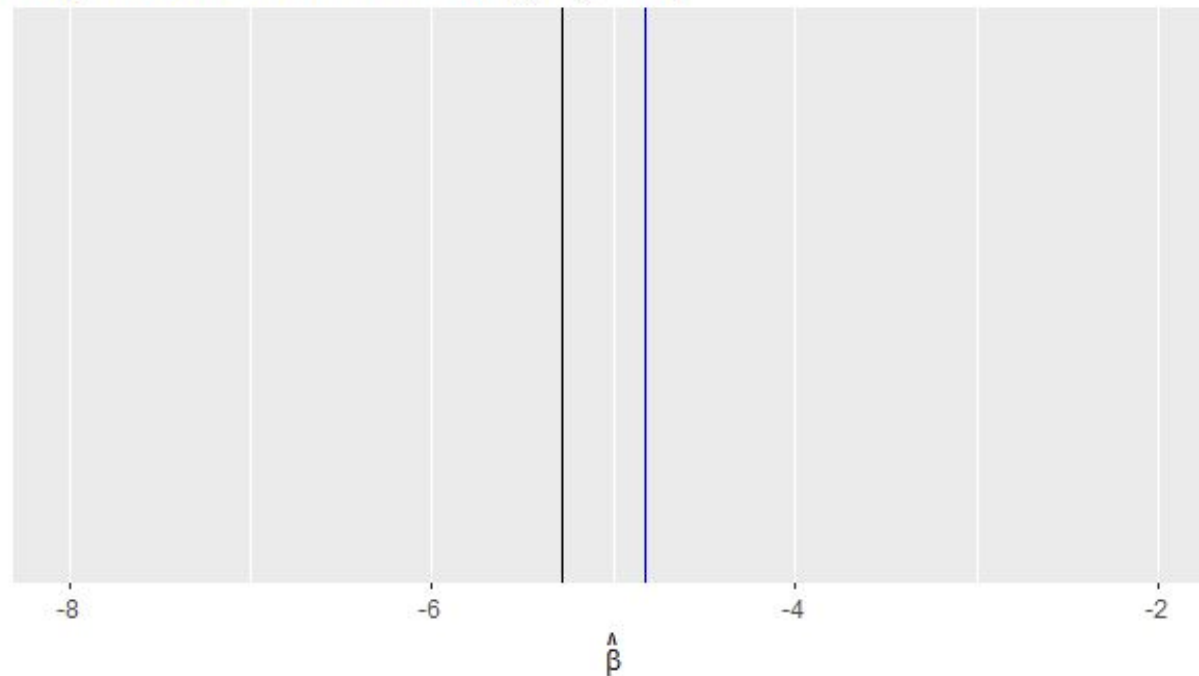


$\beta_{\text{Population}}$

-5.28

Regression Coefficients

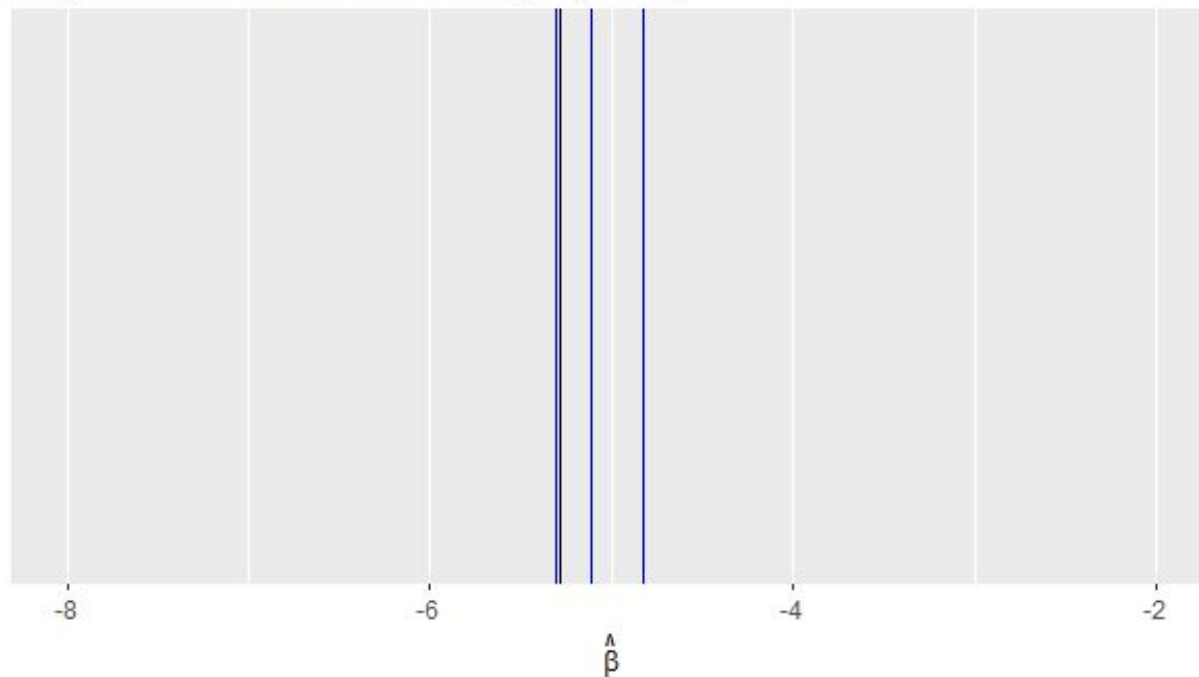
Regression Coefficient for Weight (Tons)



$\beta_{\text{Population}}$	-5.28
$\beta_{\text{Sample 1}}$	-4.83

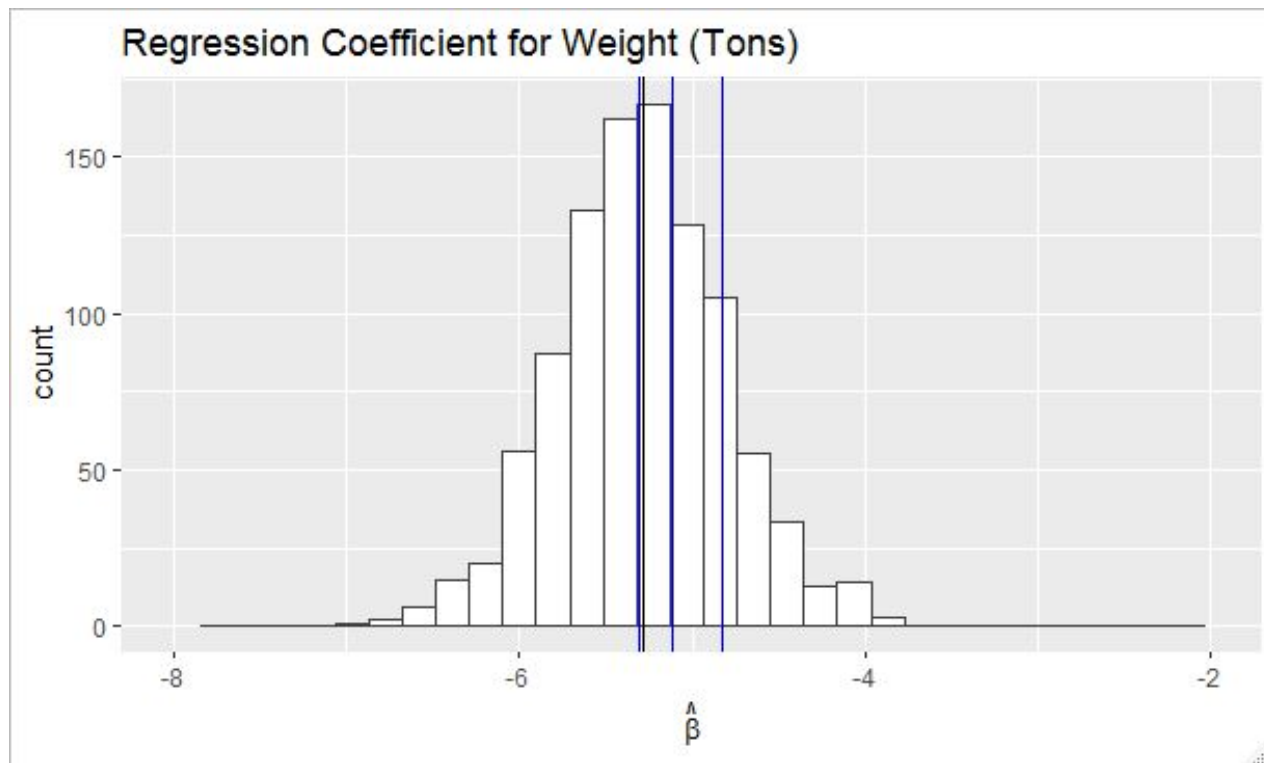
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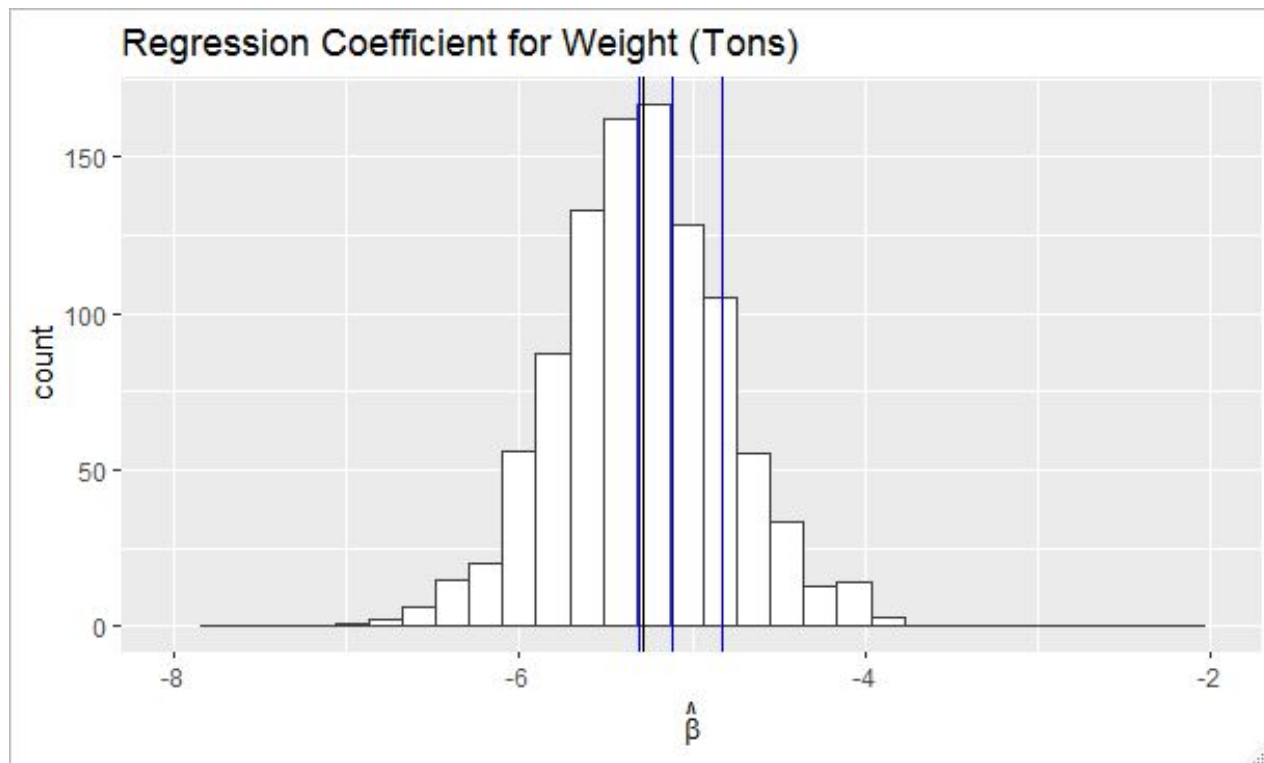


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Regression Coefficients

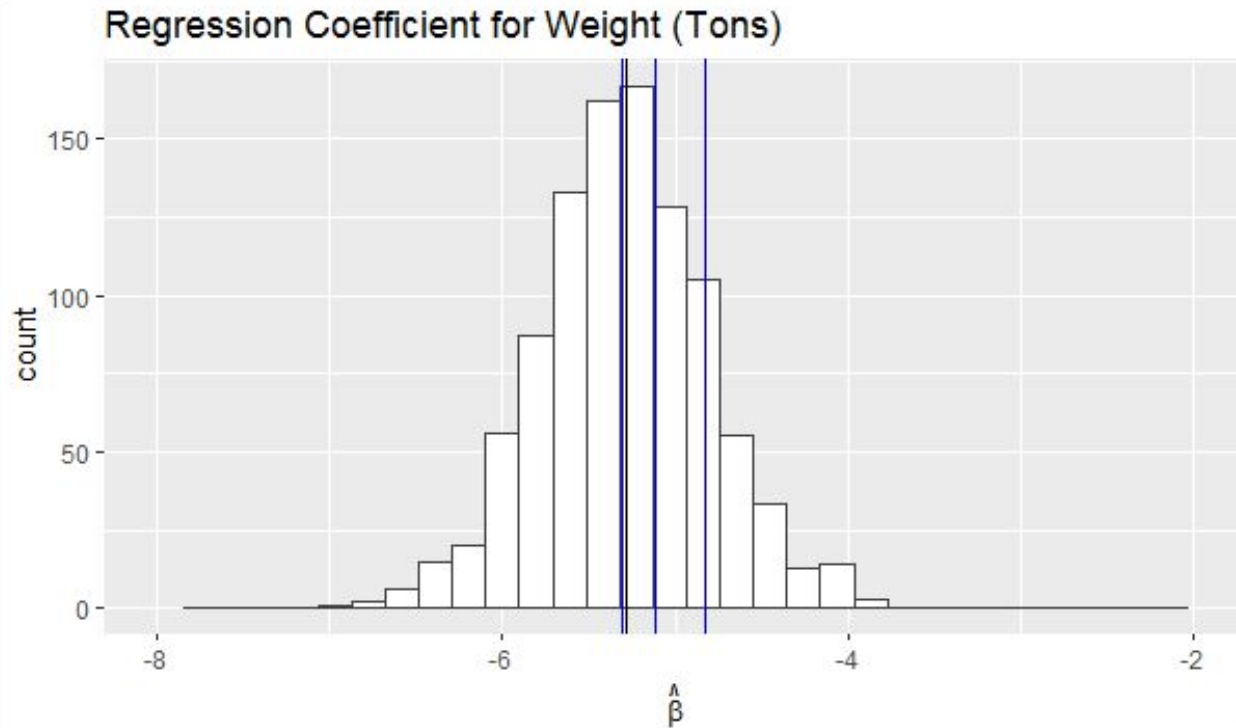


Regression Coefficients



Coefficient Mean: $-5.29 \approx -5.28$

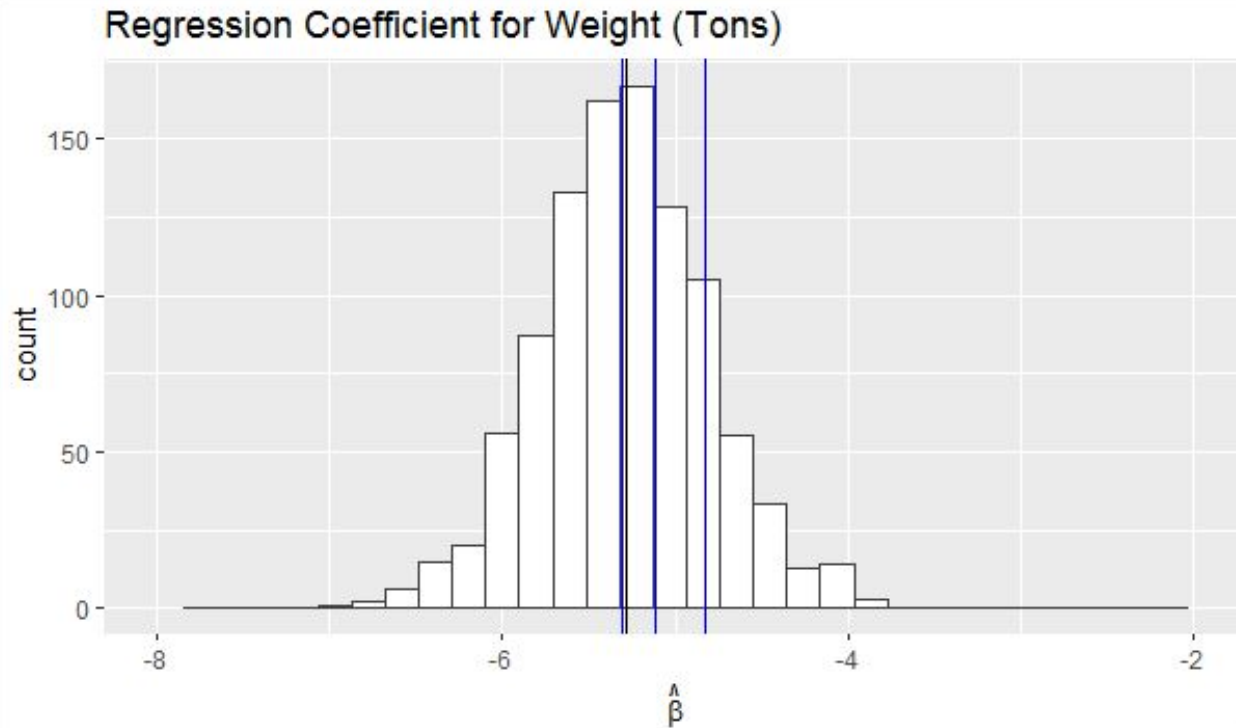
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Coefficient SD: 0.48

Regression Coefficients



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Standard Error!

Regression Coefficients

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- Used for Hypothesis Testing as well!

Regression Hypothesis Test

Regression Hypothesis Test

Null Hypothesis (H_0)

Alternative Hypothesis (H_A)

Regression Hypothesis Test

Null Hypothesis (H_0)

$$\beta = 0$$

Alternative Hypothesis (H_A)

$$\beta <, >, \neq 0$$

Regression Hypothesis Test

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< & > 1-Tail

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$$\beta <, >, \neq 0$$

< & > 1-Tail

\neq 2-Tail

Regression Hypothesis Test

- Regression Coefficients Follow a T - Distribution
(Generally speaking)

Regression Hypothesis Test

$$t = (\beta_{\text{Estimate}} - \beta_{\text{Hypothesis}}) / \text{SE}_{\beta}$$

Regression Hypothesis Test

$$t = (\beta_{\text{Estimate}} - 0) / \text{SE}_{\beta}$$

Regression Hypothesis Test

$$t = (\beta_{\text{Estimate}} - 0) / \text{SE}_{\beta}$$

Compare this t to your Student's t distribution

Regression Hypothesis Test

Example:

Regression Hypothesis Test

Example: Sample 1

	N	MPG	Wt	β_1		
Sample 1	100	23.84	4.48	-4.83		

Regression Hypothesis Test

Example: Sample 1

	N	MPG	Wt	β_1	SE_{β}	t
Sample 1	100	23.84	4.48	-4.83	0.53	-9.11

Critical t -value ($\alpha = .99$):

Regression Hypothesis Test

Example: Sample 1

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Critical t -value ($\alpha = .01$): $\sim \pm 2.626$

Regression Hypothesis Test

Example: Sample 1

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Reject the Null!!