Central Limit Theorem

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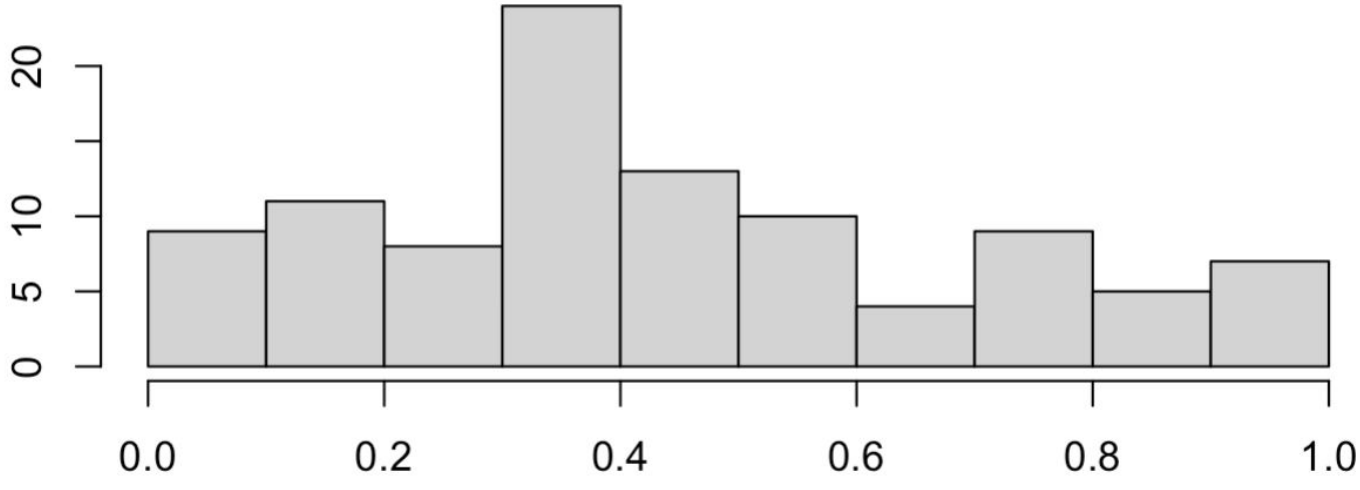
Mentored by Ronan Perry

Town X

What is my friend's political preference?

$\mathbb{E}[Y]$

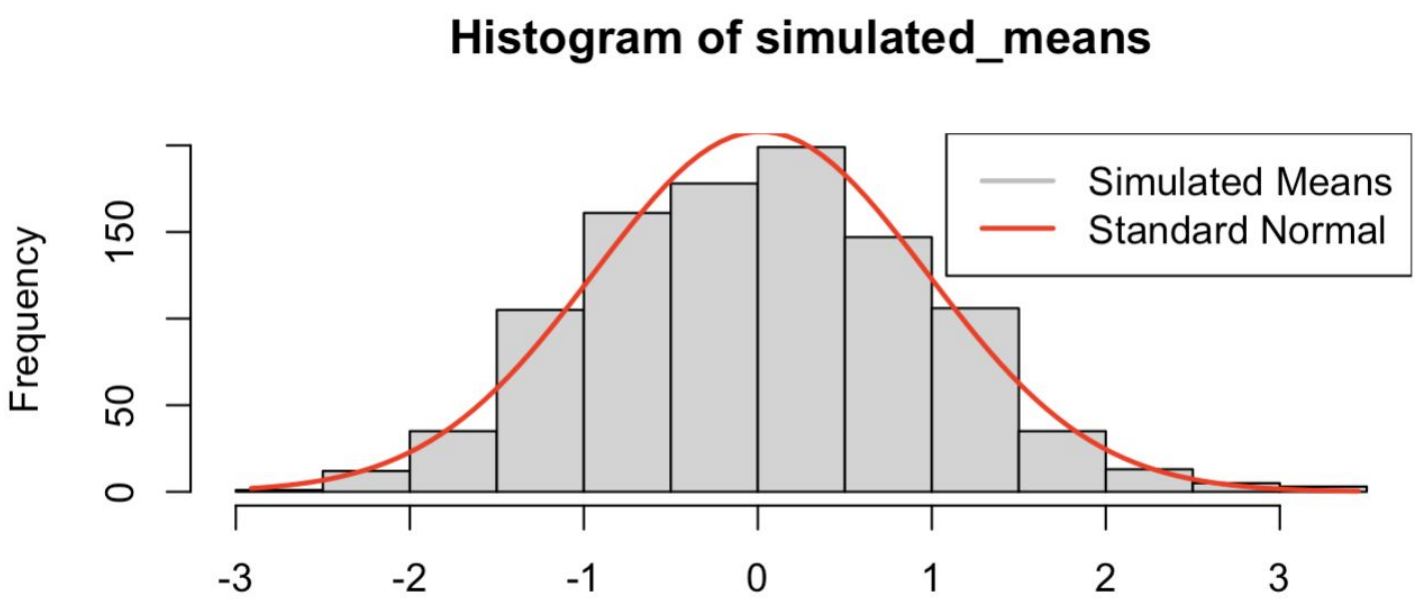


Take a Sample!

Take 10 people from the population and find the mean of their political opinion. But how does this relate to the population mean?

Central Limit Theorem! Bam! Holds regardless of the population distribution.

$$\frac{\sqrt{n}}{\sigma}(\hat{\mu} - \mu) = N(0, 1)$$


Histogram of simulated_means
Frequency
0
50
150
-3
-2
-1
0
1
2
3
Simulated Means
Standard Normal

What if we knew my friend's age?

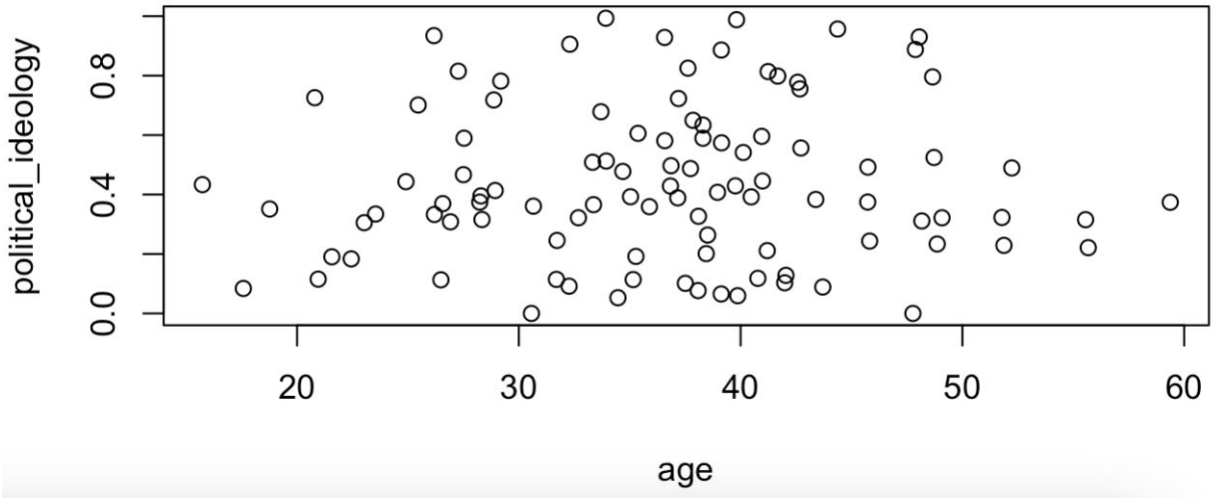
(Without loss of generality for multivariate X)

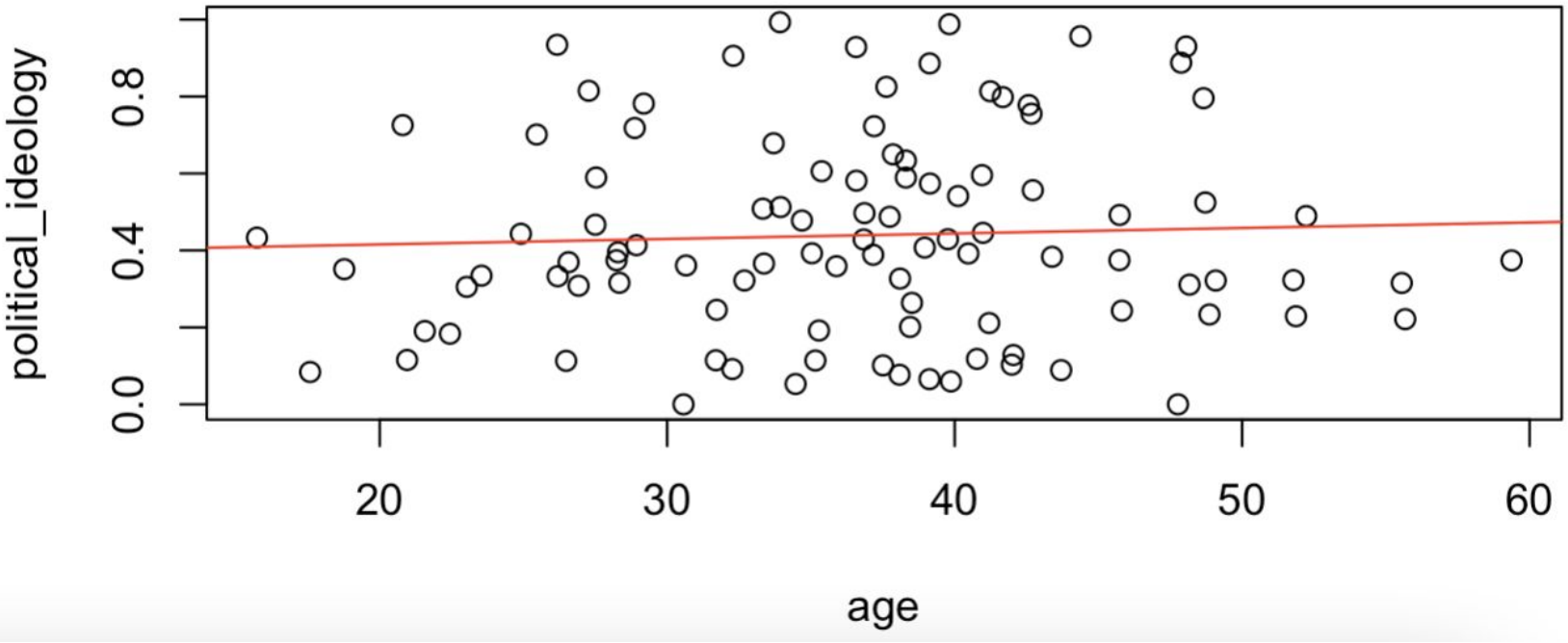
$$\mathbb{E}[Y|X]$$

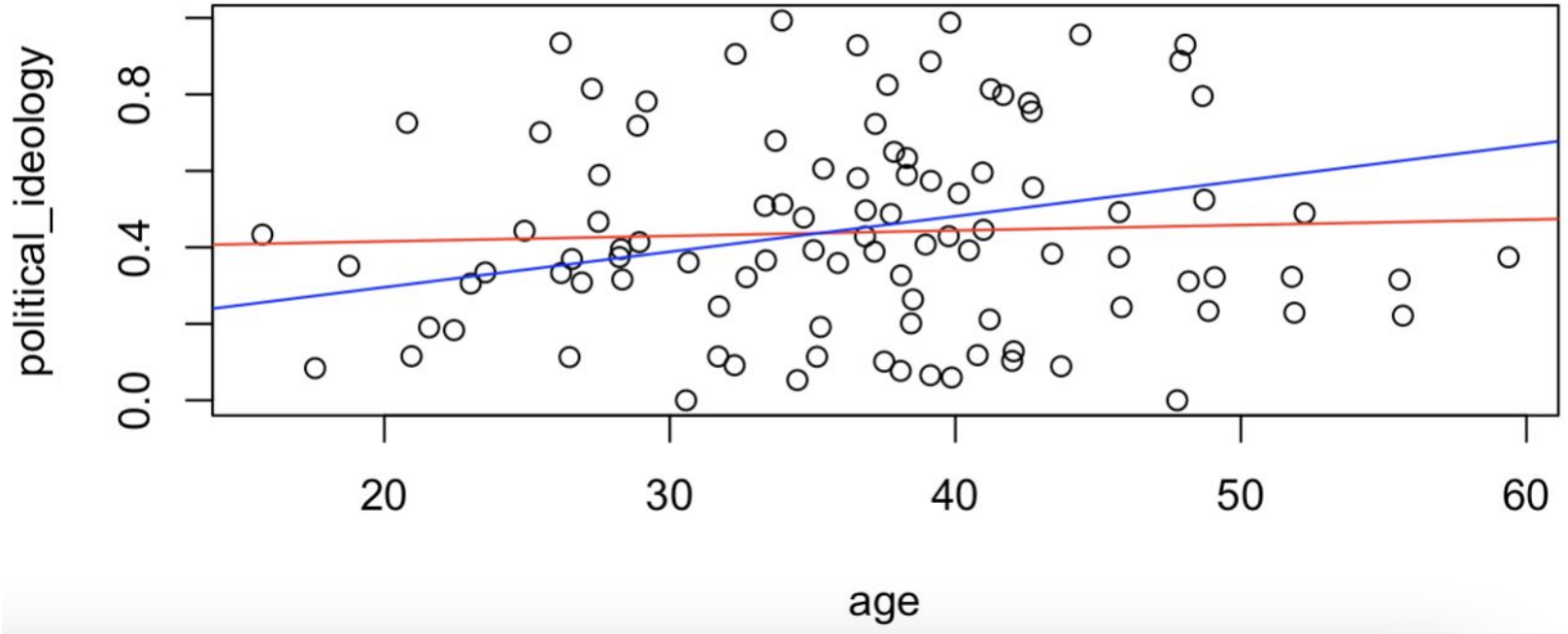
Working model:

$$Y = X\beta + \epsilon$$

Case 1: Political Opinion and Age are Independent




political_ideology
0.0
0.4
0.8
20
30
40
50
60
age


political_ideology
0.0
0.4
0.8
20
30
40
50
60
age

But how does these two lines relate to each other? How good is our prediction?

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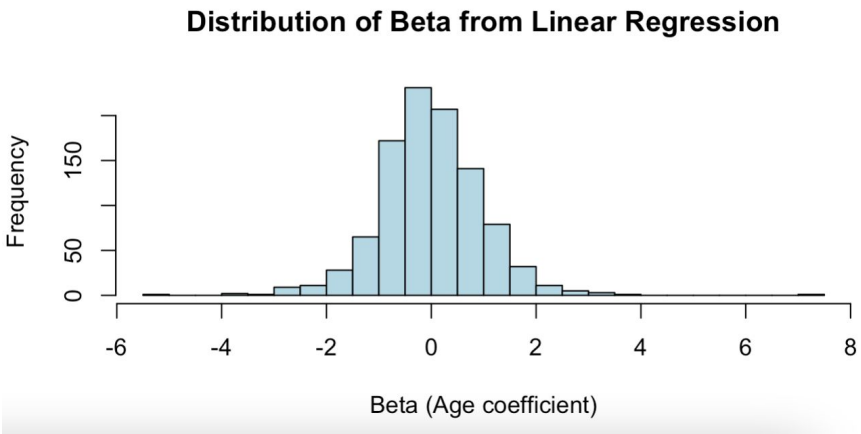
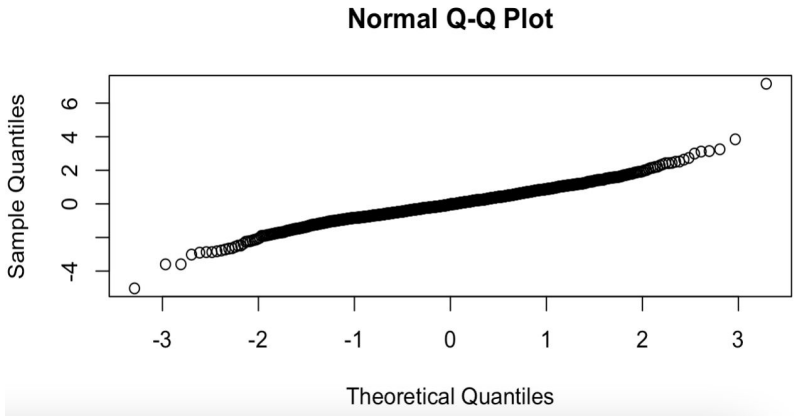
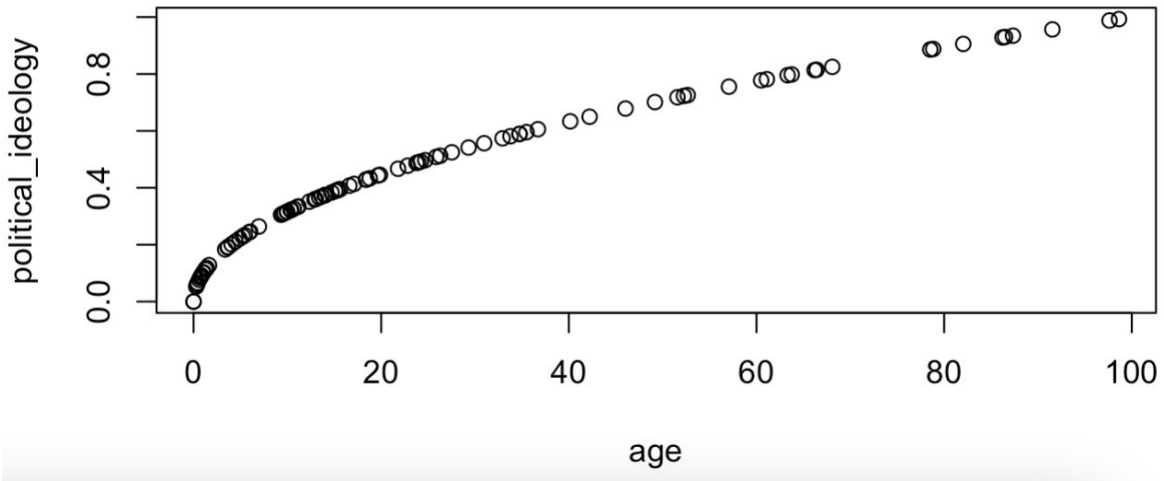
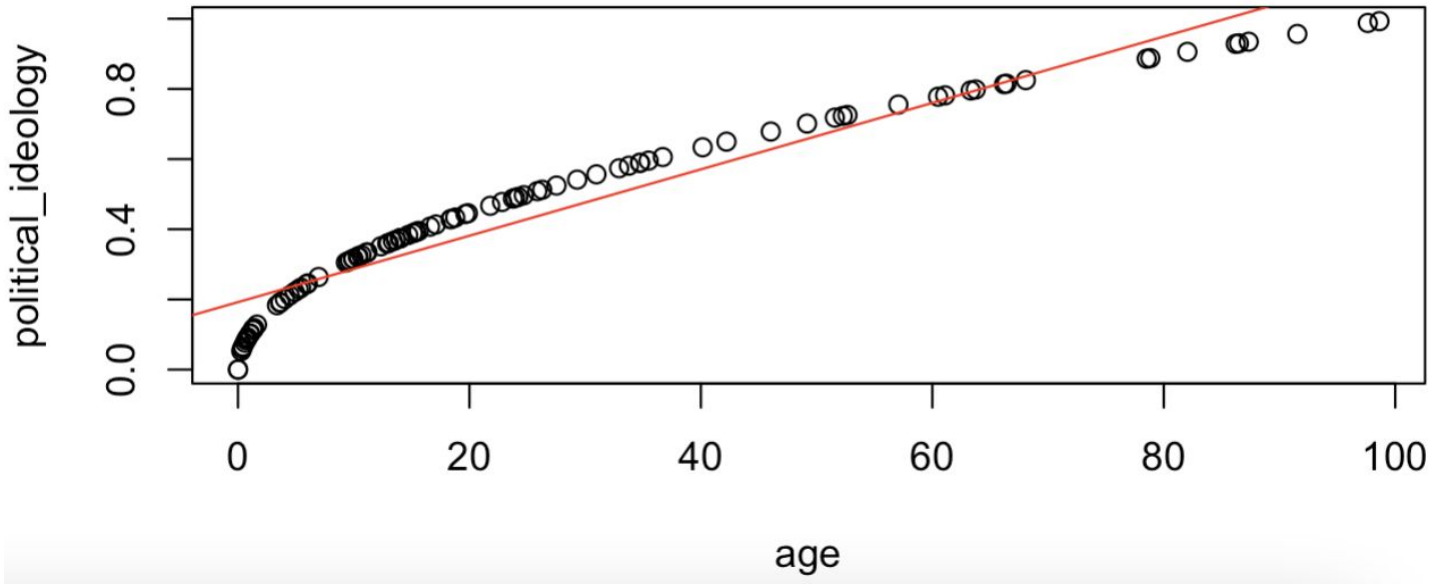
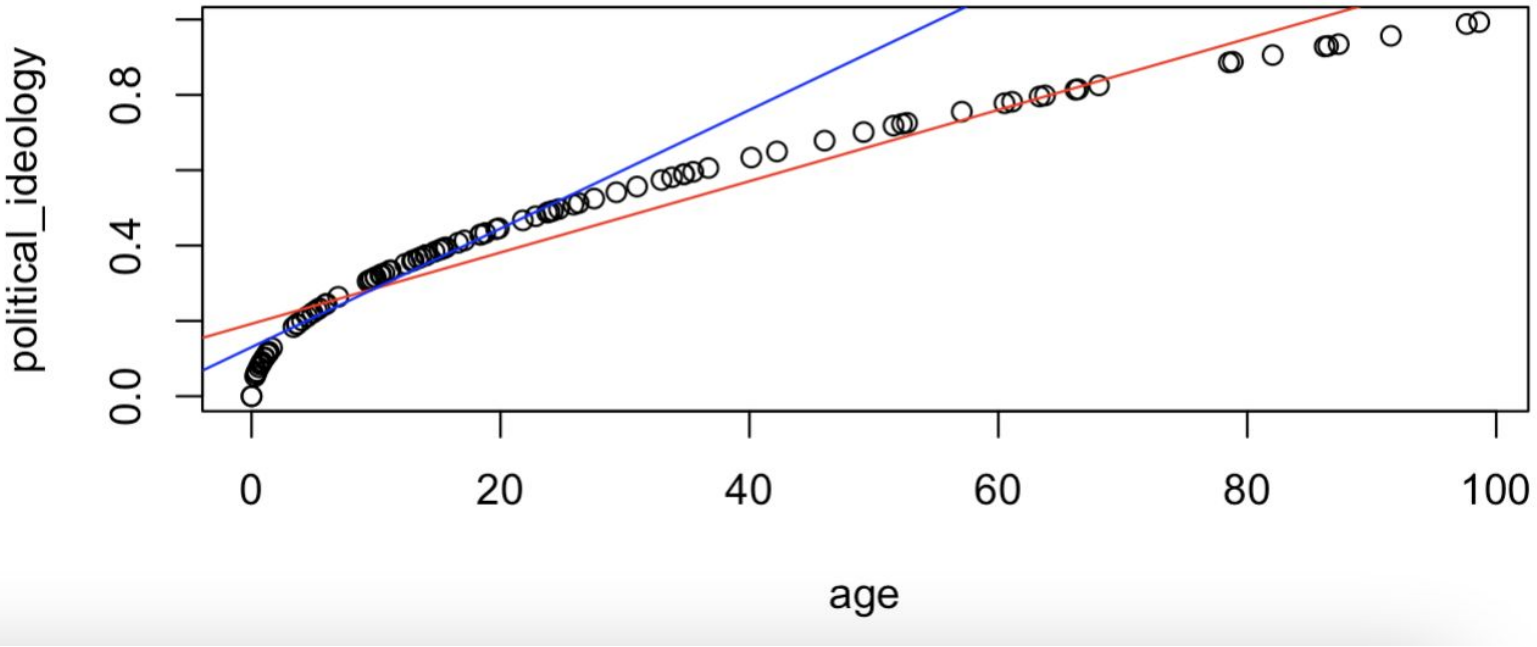




Case 2: Political Opinion and Age are related




political_ideology
0.0
0.4
0.8
0
20
40
60
80
100
age


political_ideology
0.0
0.4
0.8
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40
60
80
100
age

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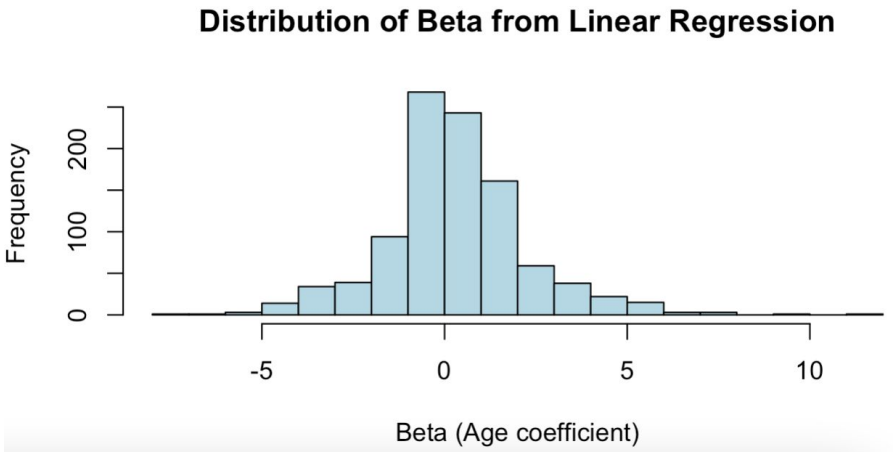

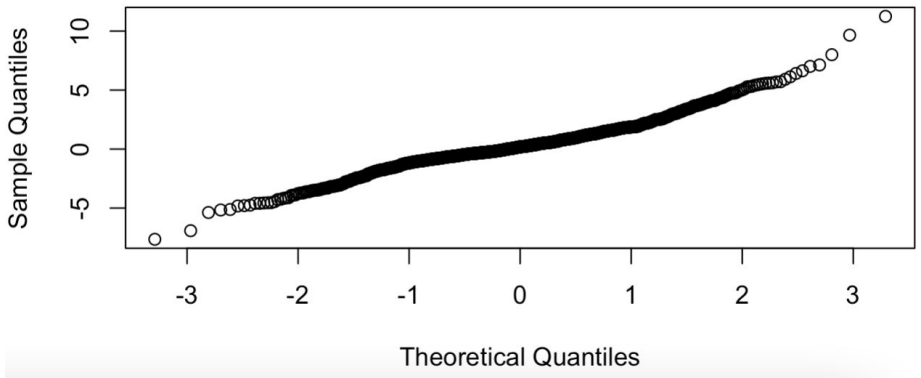

Thank you!