

Are newer cars more efficient than older ones?

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Introduction

DATA SET

Our data set contains the properties of electric cars such as Tesla, Kia, Nissan, Ford, Chevrolet, Smart, and Mitsubishi.

ARTICLE

Our research question is derived from an article from GreenBiz.





Methodology

DATA CLEANING

We look through the data for any errors or redundancy

HYPOTHESIS

We formulate our hypothesis and test it

PLOT TABLES/GRAPHS

We use tables and graphs to interpret our given data



Data Cleaning



04



Delete Columns With Null Values

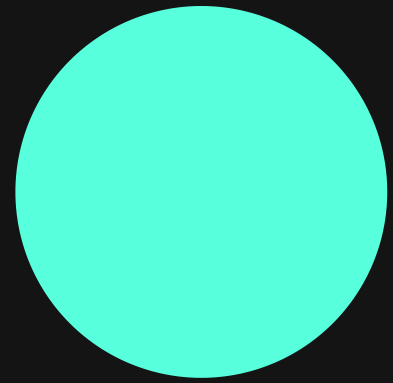
Delete Columns With the Same
Values in the Column

Rename Columns

Data Cleaning

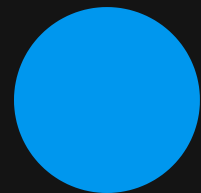
	YEAR	Make	Model	Size	(kW)	Unnamed: 5	TYPE	CITY (kWh/100 km)	HWY (kWh/100 km)	COMB (kWh/100 km)	CITY (Le/100 km)	HWY (Le/100 km)	COMB (Le/100 km)	(g/km)	RATING	(km)	TIME (h)
0	2012	mitsubishi	i-MiEV	SUBCOMPACT	49	A1	B	16.9	21.4	18.7	1.9	2.4	2.1	0	NaN	100	7
1	2012	NISSAN	LEAF	MID-SIZE	80	A1	B	19.3	23.0	21.1	2.2	2.6	2.4	0	NaN	117	7
2	2013	FORD	FOCUS ELECTRIC	COMPACT	107	A1	B	19.0	21.1	20.0	2.1	2.4	2.2	0	NaN	122	4
3	2013	mitsubishi	i-MiEV	SUBCOMPACT	49	A1	B	16.9	21.4	18.7	1.9	2.4	2.1	0	NaN	100	7
4	2013	NISSAN	LEAF	MID-SIZE	80	A1	B	19.3	23.0	21.1	2.2	2.6	2.4	0	NaN	117	7

	Year	Make	Model	Size	(kW)	City_kWh	Hwy_kWh	Comb_kWh	City_Le	Hwy_Le	Comb_Le	(km)	Time	Before_2015
0	2012	mitsubishi	i-MiEV	SUBCOMPACT	49	16.9	21.4	18.7	1.9	2.4	2.1	100	7	1.0
1	2012	NISSAN	LEAF	MID-SIZE	80	19.3	23.0	21.1	2.2	2.6	2.4	117	7	1.0
2	2013	FORD	FOCUS ELECTRIC	COMPACT	107	19.0	21.1	20.0	2.1	2.4	2.2	122	4	1.0
3	2013	mitsubishi	i-MiEV	SUBCOMPACT	49	16.9	21.4	18.7	1.9	2.4	2.1	100	7	1.0
4	2013	NISSAN	LEAF	MID-SIZE	80	19.3	23.0	21.1	2.2	2.6	2.4	117	7	1.0



As the years go up, the combined efficiency increases for each electric car

Hypothesis



- $H_0: \beta_j = 0$ (no impact)
- $H_1: \beta_j \neq 0$ (have an impact)
 - Decision Rule: Reject the null hypothesis if $p\text{-value} < \alpha = 0.05$.



Variables of interest



OUTCOME VARIABLE

Combined Efficiency(kWh/100km)

MAIN EXPLANATORY VARIABLE

Dummy Variable (Before_2015)


CONTROL VARIABLE

Size



Regression Model

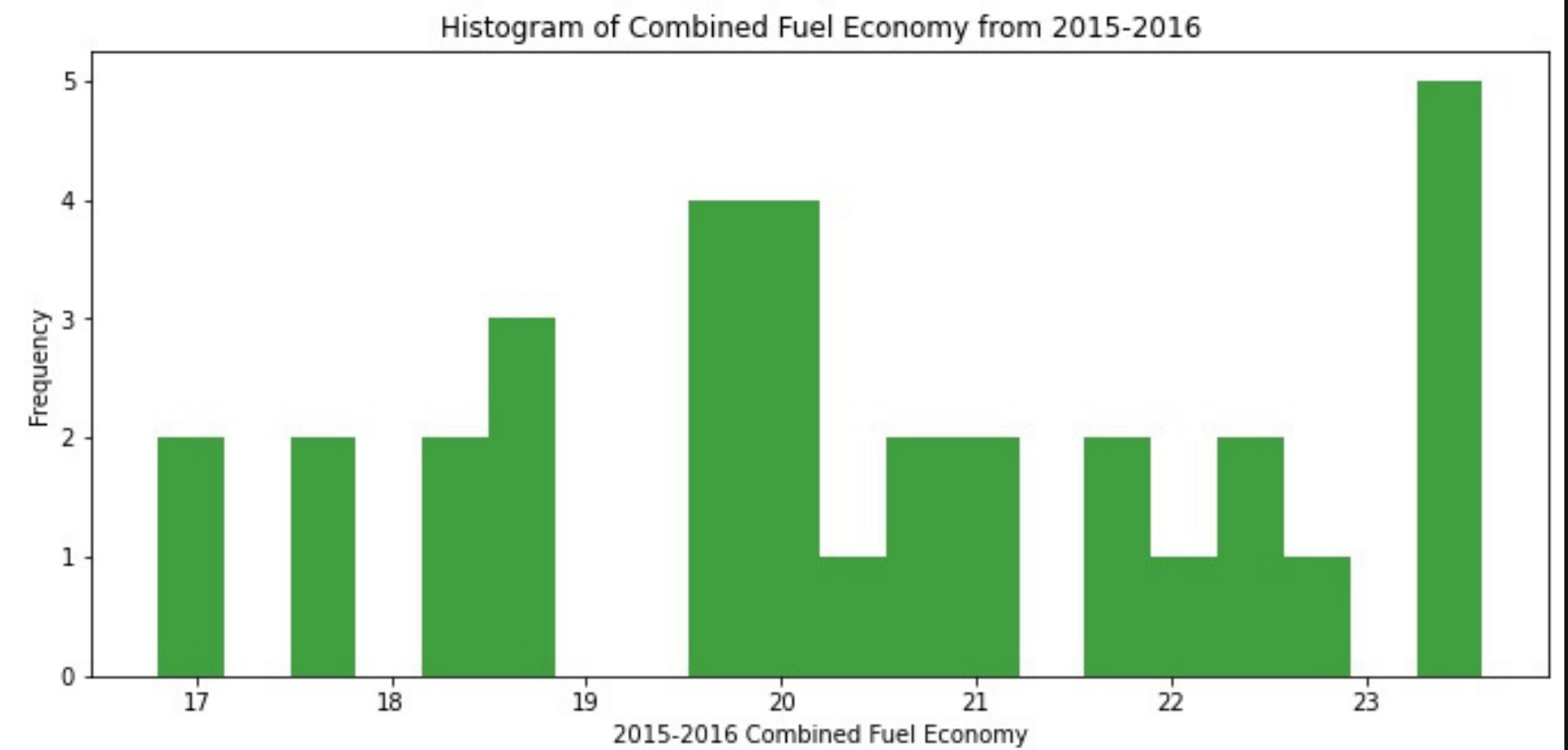
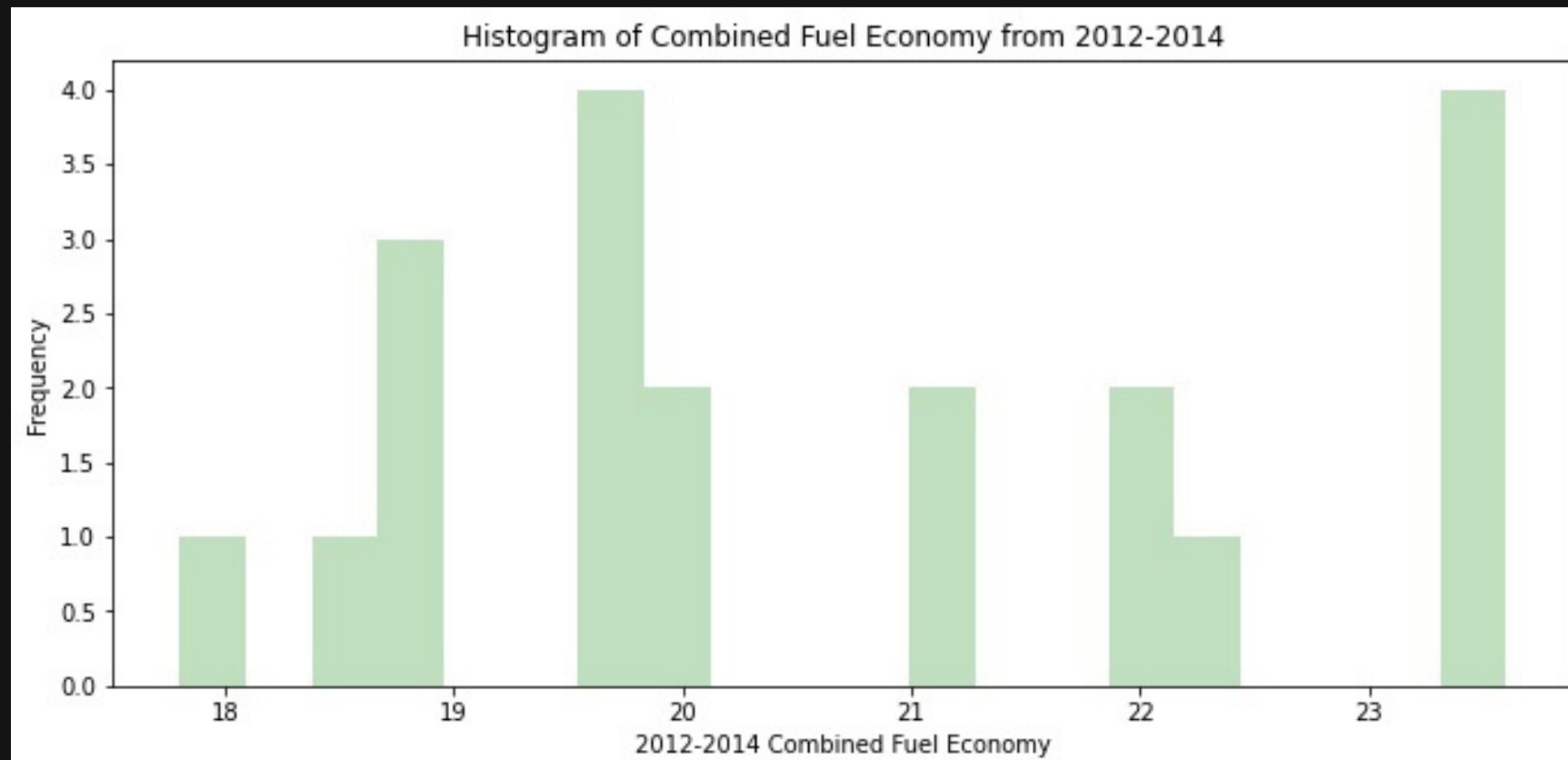
08


$$Y \approx \beta_0 + \beta_1 X_1 + \beta_2 X_2 + \cdots + \beta_n X_n$$

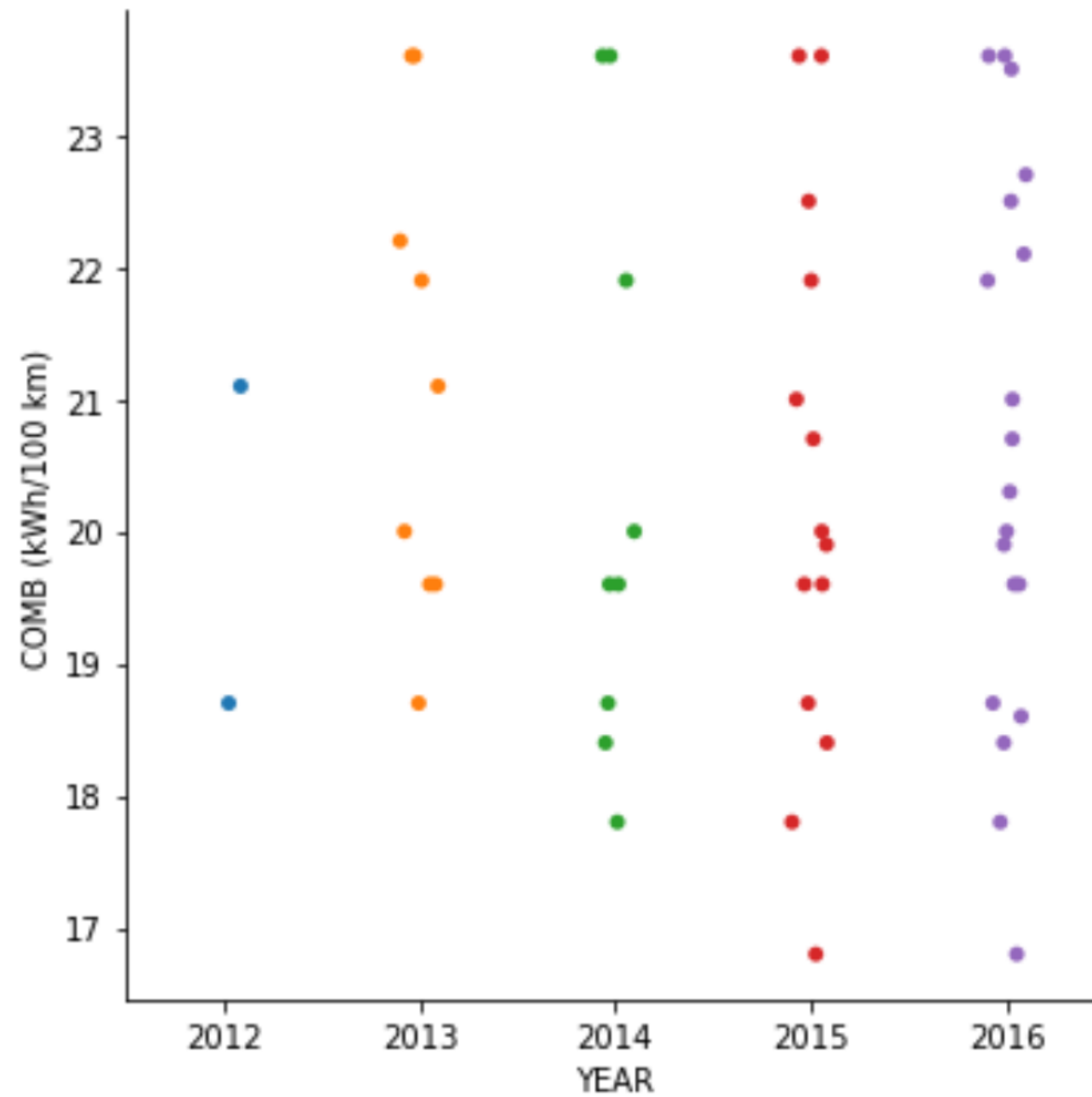
Comb_kWh = B0+B1(Before_2015) +
B2(Size) + error

What will we find?

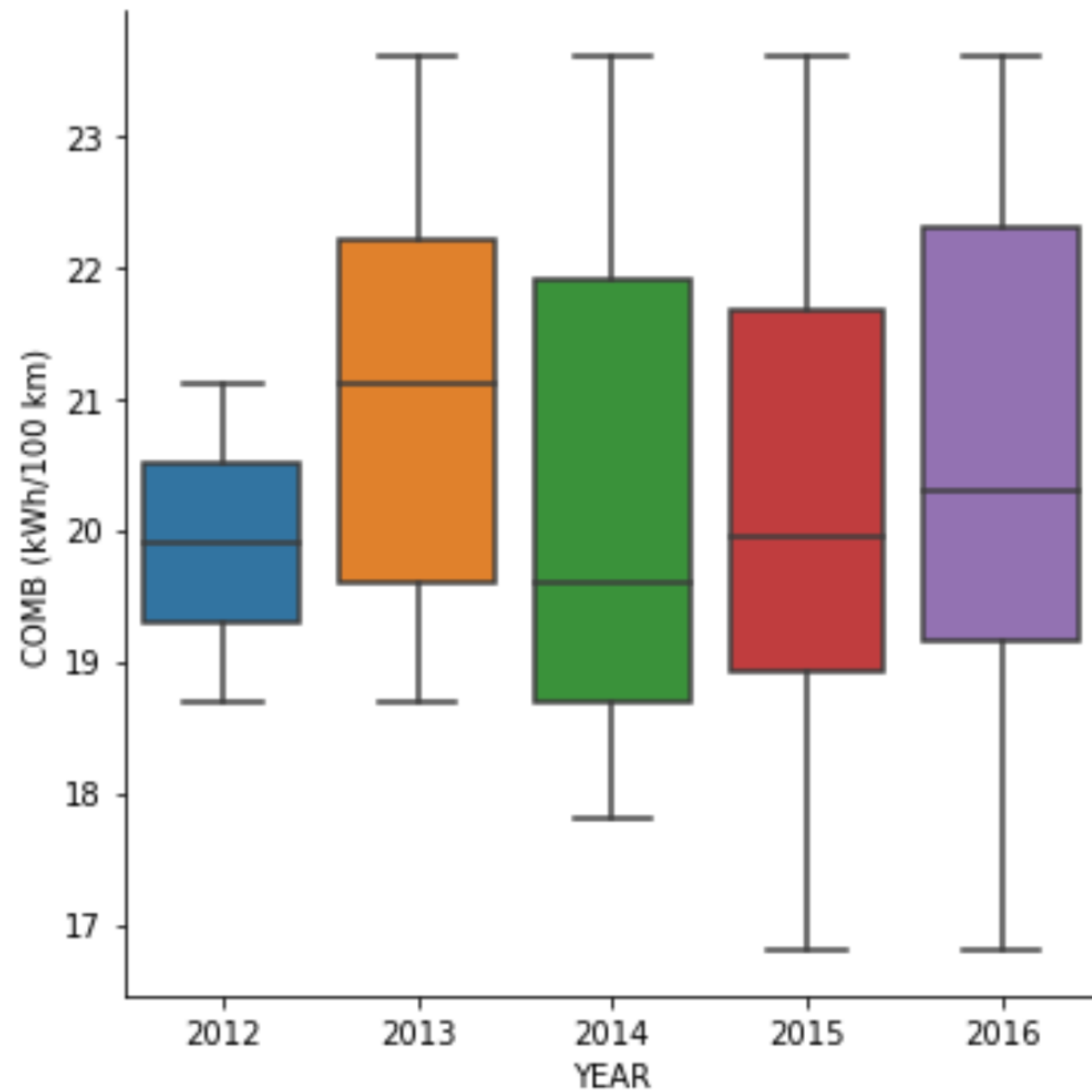
Graphs



Graphs



Graphs



Results

Are Newer Cars More Efficient?

Before vs After 2015	
Intercept	19.64*** (0.47)
Before_2015	0.71*** (0.26)
Size[T.STATION WAGON - SMALL]	0.26 (0.79)
Size[T.SUV - STANDARD]	3.46*** (0.79)
Size[T.TWO-SEATER]	-0.40 (0.55)
Size[T.SUBCOMPACT]	-1.88*** (0.53)
Size[T.FULL-SIZE]	2.47*** (0.49)
Size[T.MID-SIZE]	-0.67 (0.58)
R-squared	0.82
R-squared Adj.	0.80

Interpret Coefficients.

$$\text{Comb_kWh} = 0.71(\text{Before_2015}) + 3.46(\text{T.SUV - Standard}) - 1.88(\text{T.Subcompact}) + 2.47(\text{T.Full - Size}) + 19.64$$

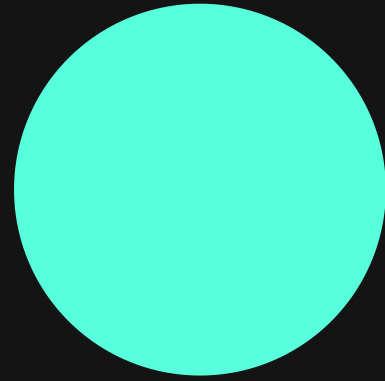
R-Squared

Conclusion

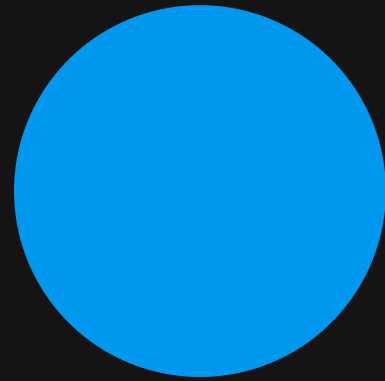
All other things being equal, when the car is made before 2015 the Comb_kWh increases by 0.71 (kWh/100km) which means that the cars made before 2015 are less efficient than newer cars.

Since we have rejected our null hypothesis, we can say that we have enough evidence that newer cars are more efficient even though it is only by 0.71 (kWh/100km)

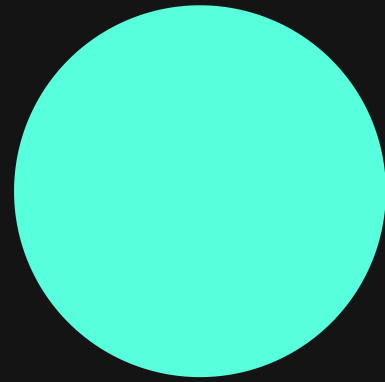
Limitations



Minimum variation in the years



Not enough variation in the car makes



Not looking at individual efficiencies (highway and city)

Recommendation

New car models should have higher efficiency than older cars.



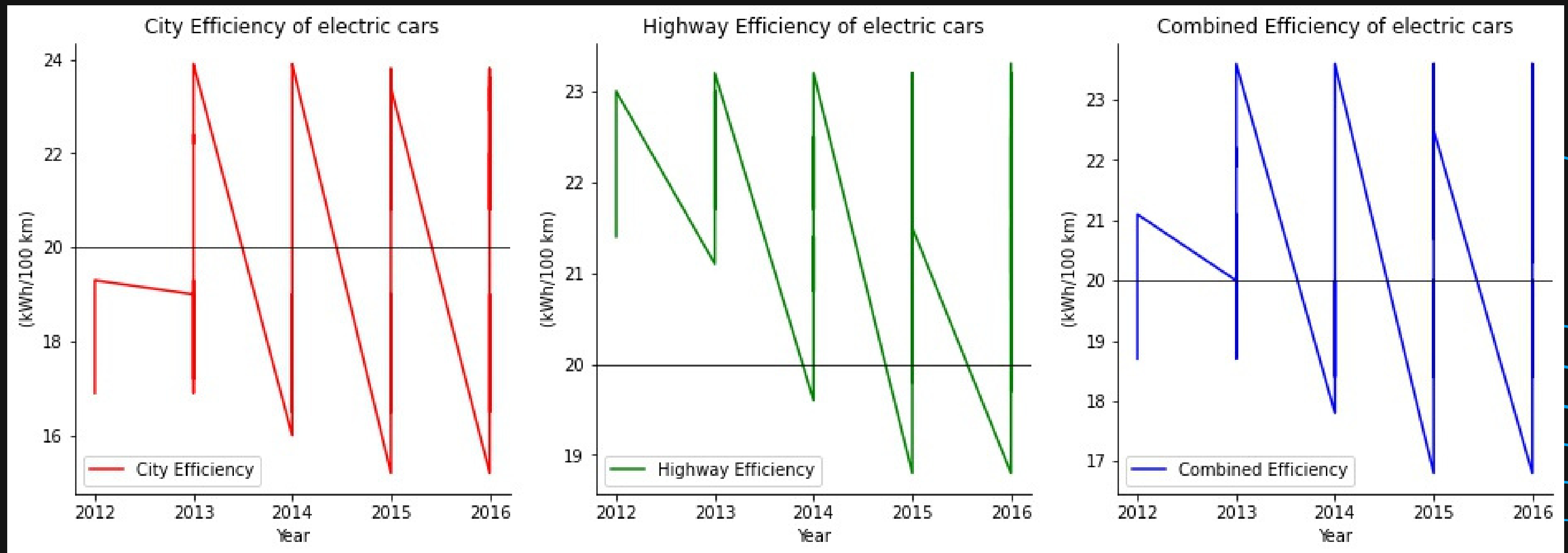
References



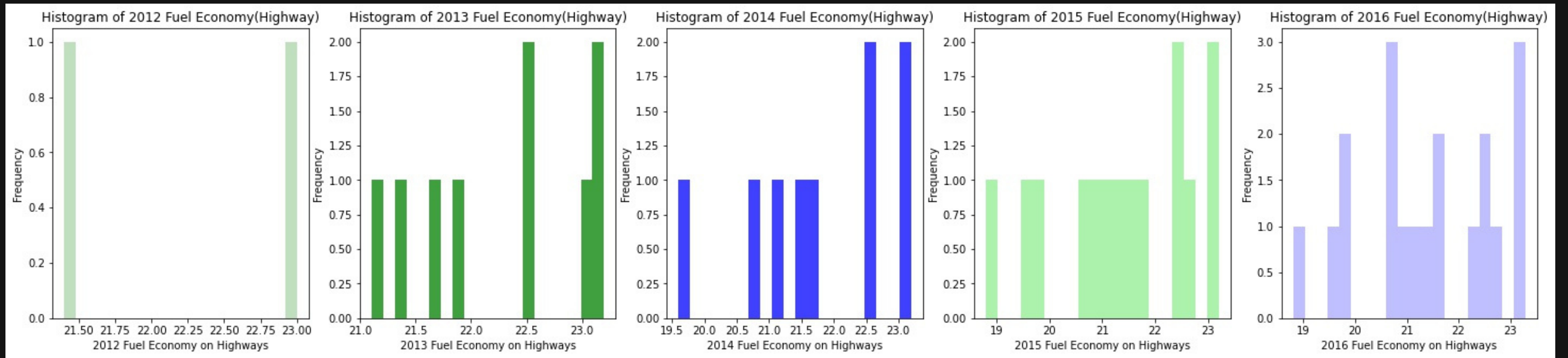
GREENBIZ

DeCicco, John. "A greener auto fleet requires increasing fuel efficiency and selling electric vehicles." GreenBiz, 9 Feb 2021, <https://www.greenbiz.com/article/greener-auto-fleet-requires-increasing-fuel-efficiency-and-selling-electric-vehicles>. Accessed 30 March 2021.

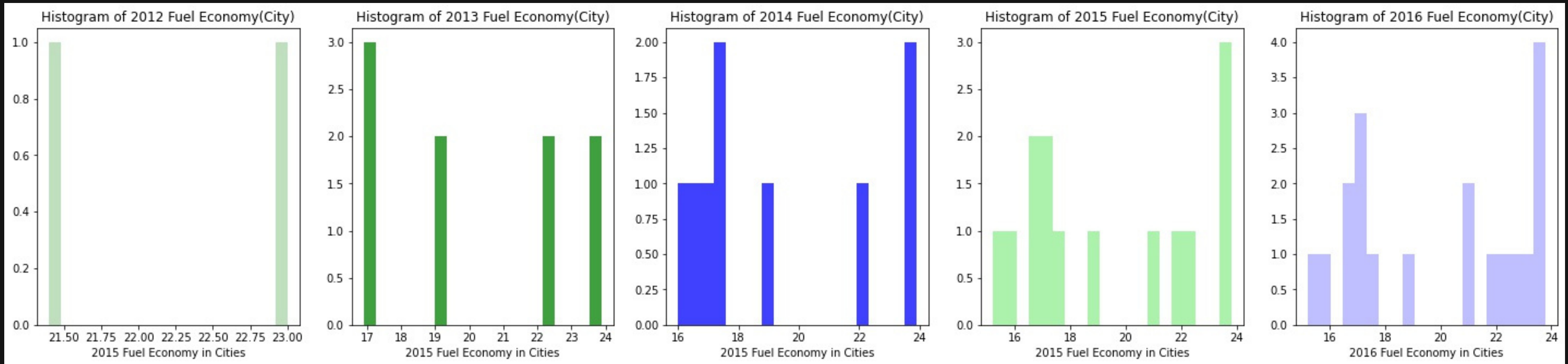
Appendix



Appendix



Appendix



Appendix

