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Presentation of Results Draft

Maps

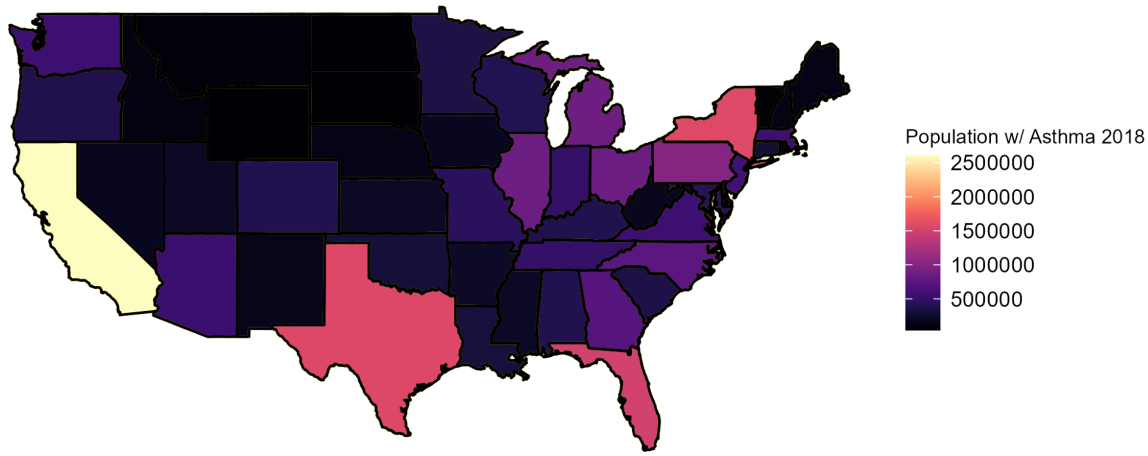

Figure 1. Map of population with asthma across each state. Here, we see that states on the East Coast feature higher quantities of people with asthma. We point out that California and New York have the highest reported populations of people with asthma.

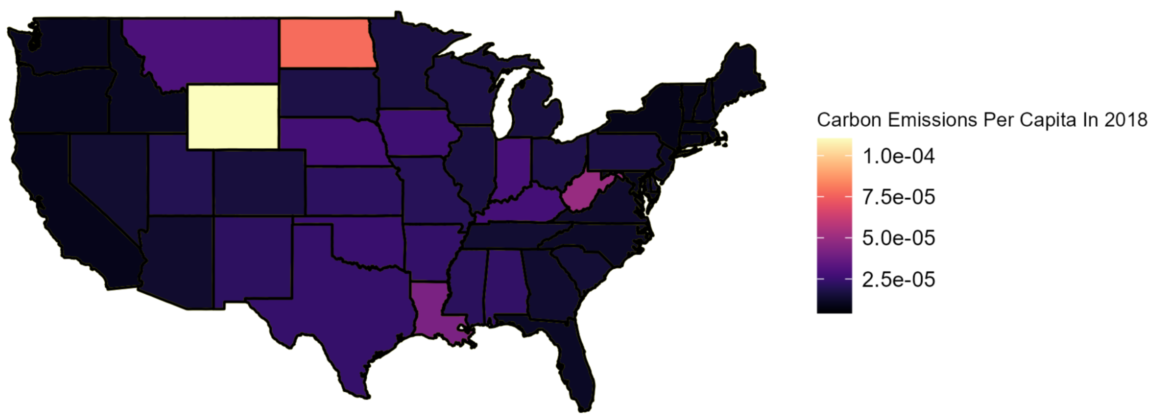

Figure 2. Map of carbon emissions (in million metric tons) per capita in 2018. This is a standardization to account for population when reporting state carbon emission data. The numerical values are meant to represent a scale rather than a measurement. On average, the data shows that states on either coast of the United States produce less carbon emissions comparable to the Midwest.

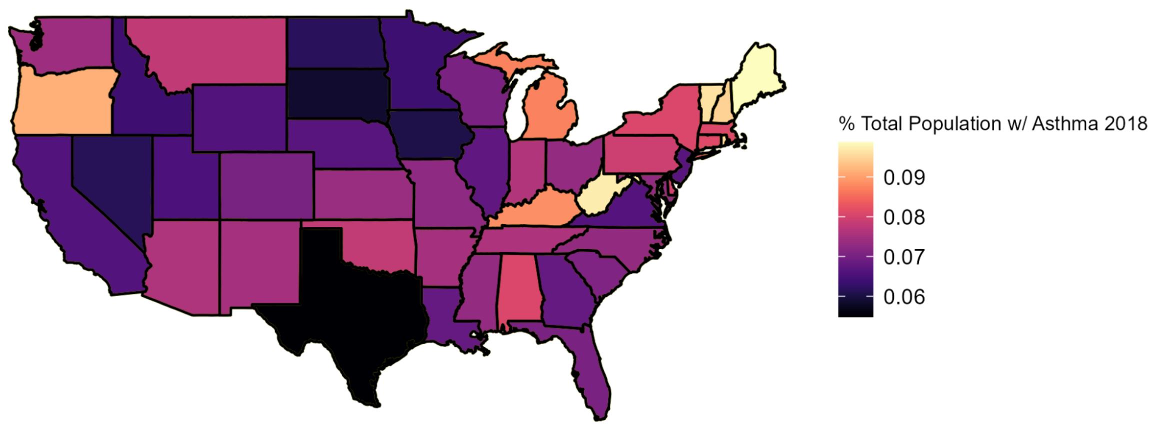

Figure 3. Map of the percentage of the total population with reported asthma in each state. This map is an alternative to Figure 1, where we attempt to consolidate potential confounders like population density by including a percentage of the total population. Like all the other maps, lighter colors represent higher values, and darker colors represent lower values. We see that Maine and West Virginia feature the highest percentages of people with asthma, possibly due to a difference in climate or the presence of mining sites.

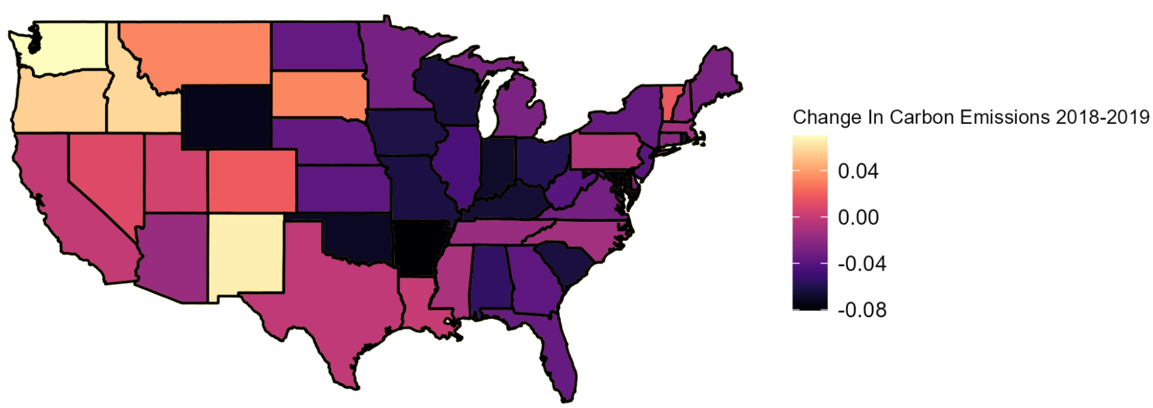

Figure 4. Map of carbon emissions (in million metric tons) per capita in 2018. This is a standardization to account for population when reporting state carbon emission data. The numerical values are meant to represent a scale rather than a measurement. On average, the data shows that states on either coast of the United States produce more carbon emissions comparable to the Midwest.

Histograms

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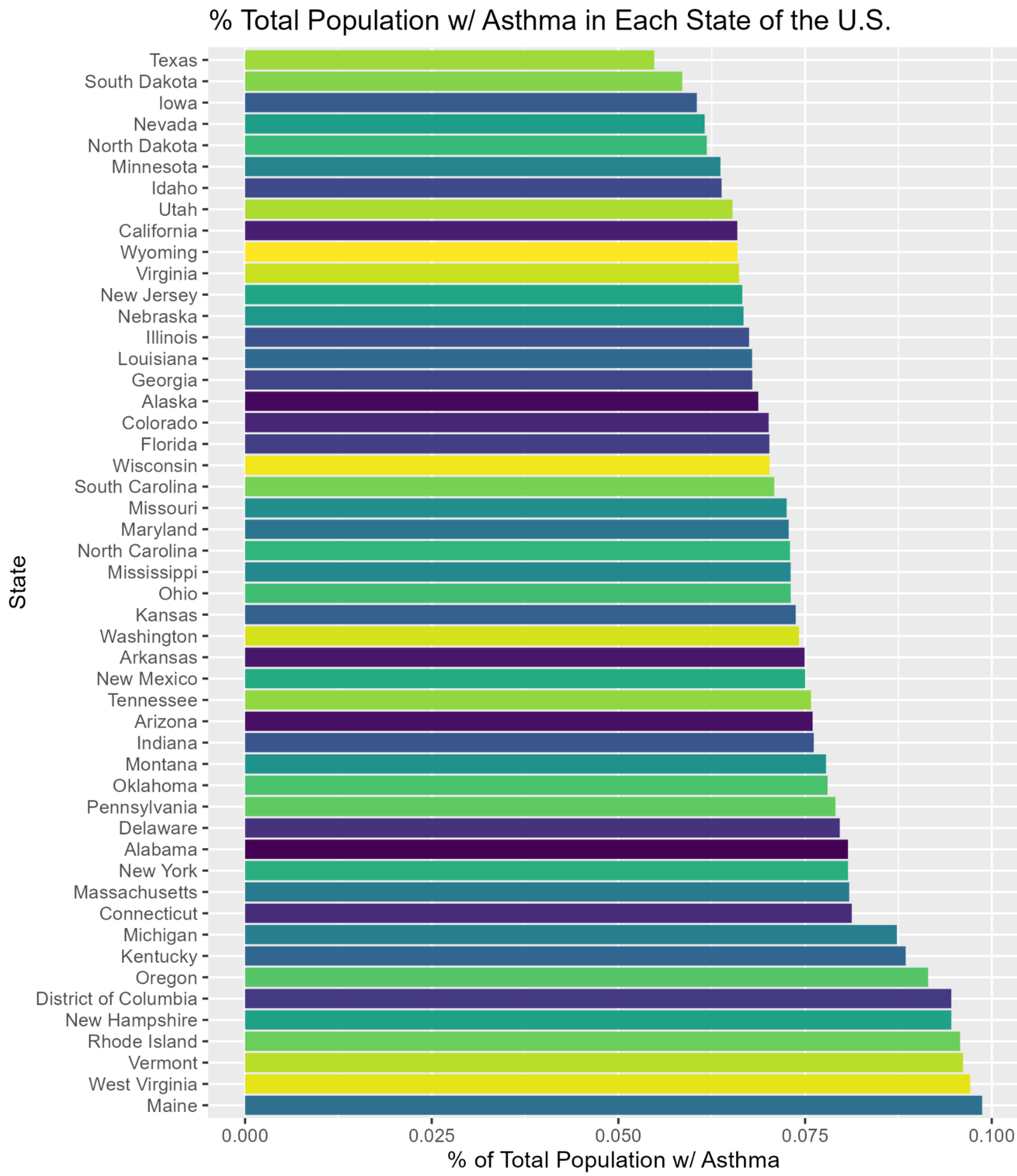

Figure 1. This histogram is a different way to visualize the percentage of the total population that has reported asthma from largest to smallest. Here, we see that West Virginia and Maine featured the highest

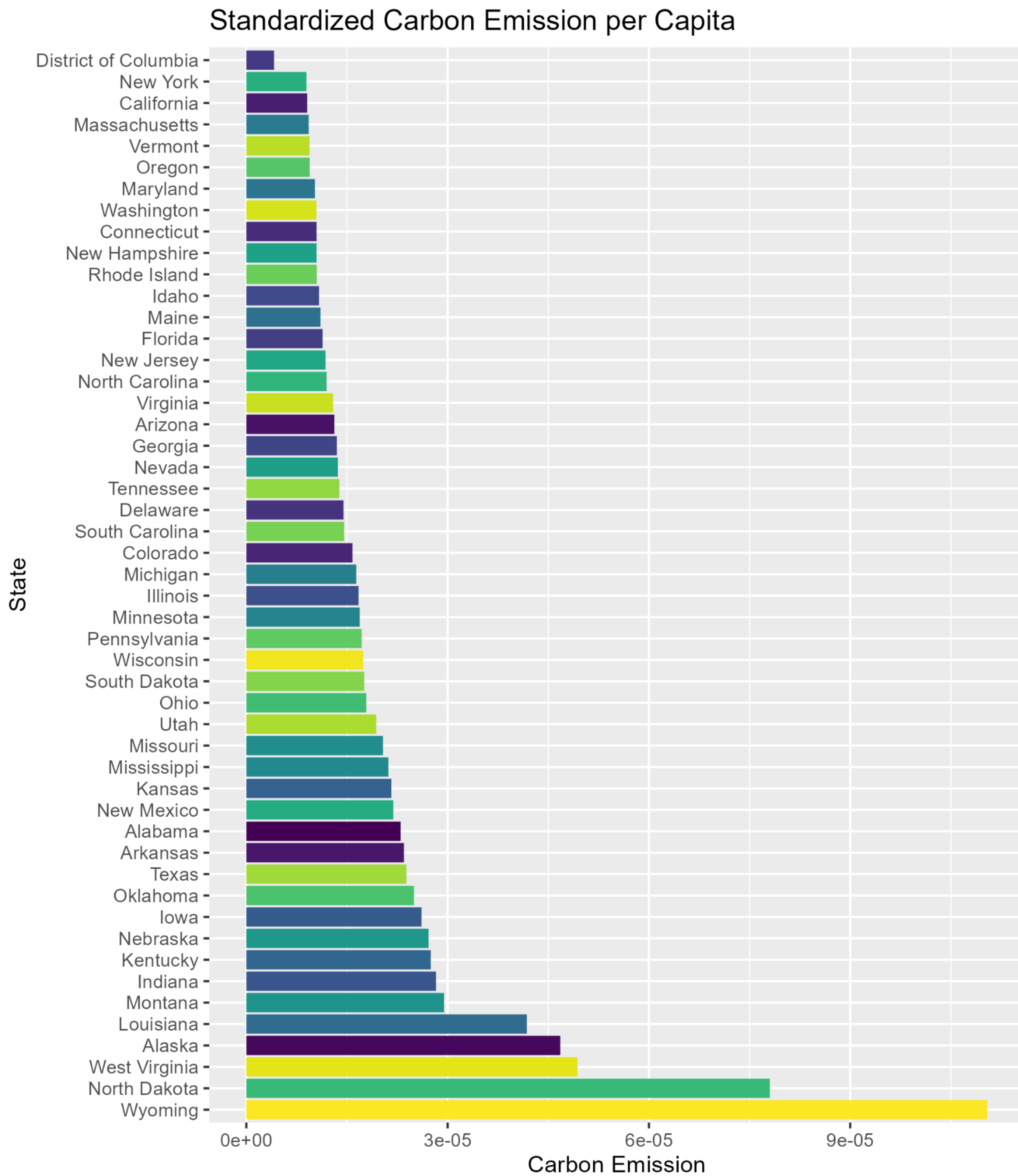

Figure 2. Histogram of carbon emissions (in million metric tons) for each state in 2018 from lowest to highest. The total carbon emission in each state was divided by the population to account for state size and population density. The histogram shows that the states on either coast produced fewer carbon emissions than the Midwest in 2018. The histogram is a different way to visualize the data in Figure 1. where we can see that Wyoming has the highest carbon emission per capita.

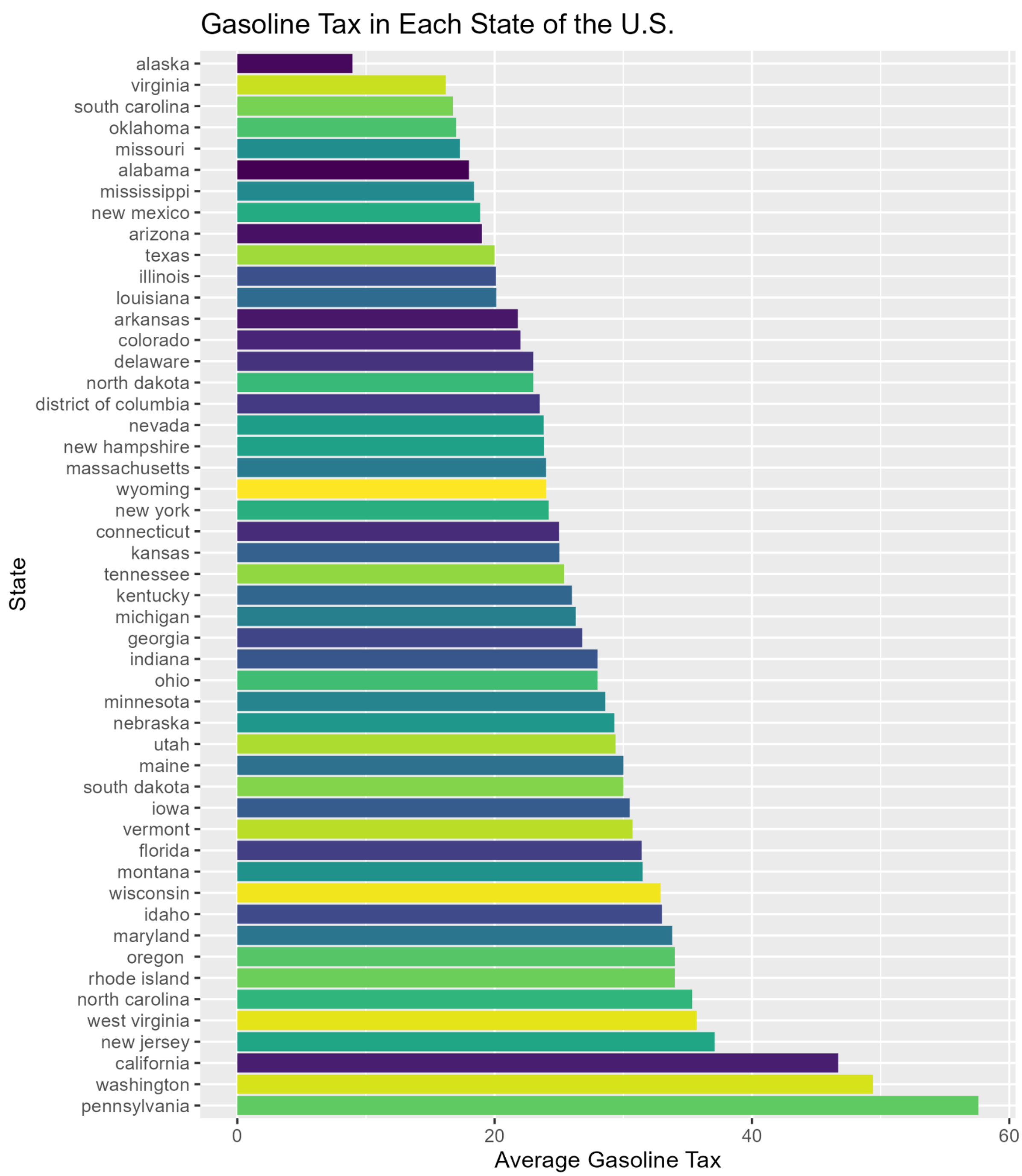

Figure 3. Histogram of the gasoline tax of each state in 2018. This visualization shows that the states with the highest average gasoline tax are on either coast, with Pennsylvania as the state with the highest average gasoline tax in 2018.

Regression Analysis

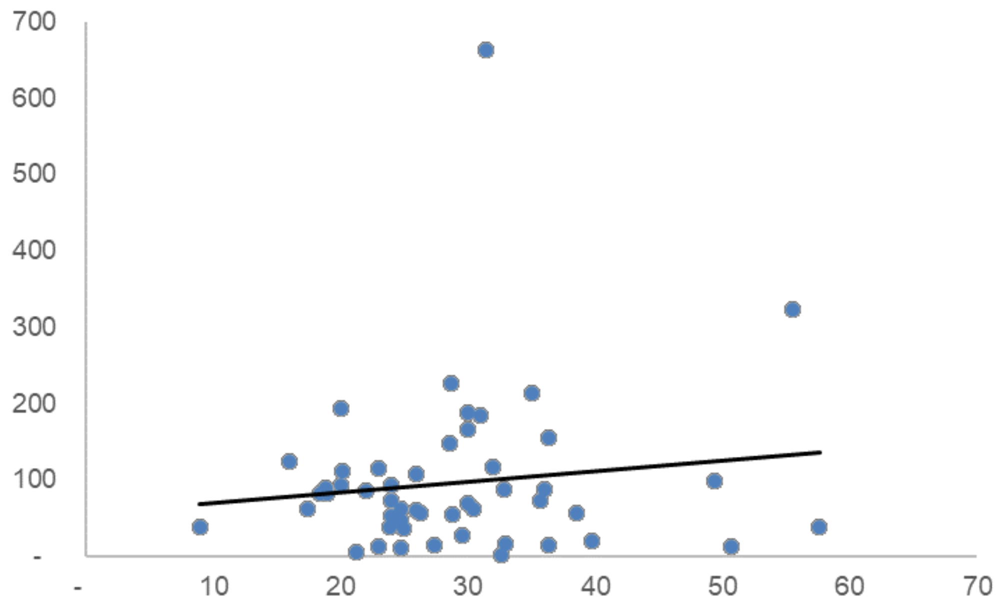

Figure 4. Dot plot of 2018 tax rate on gasoline vs. emission. As the graph shown, we can see a clear linear relationship.

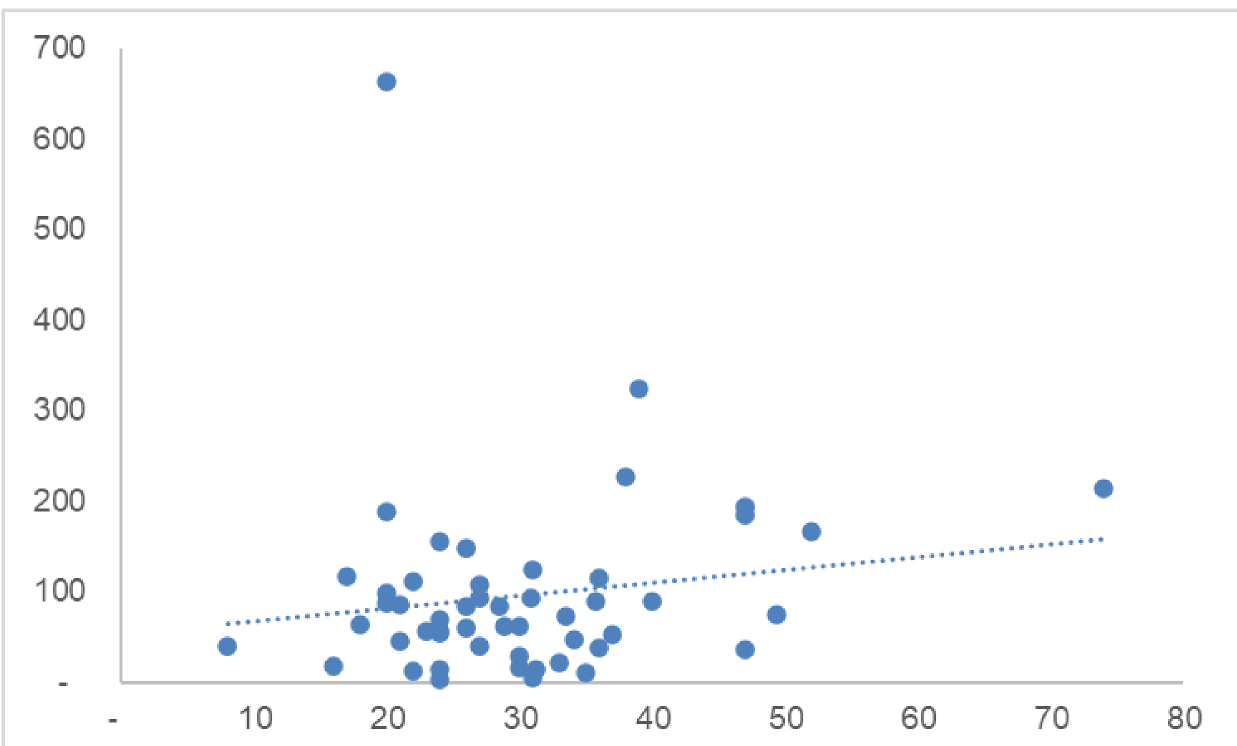

Figure 5. Dot plot of 2018 tax rate on diesel vs. emission.

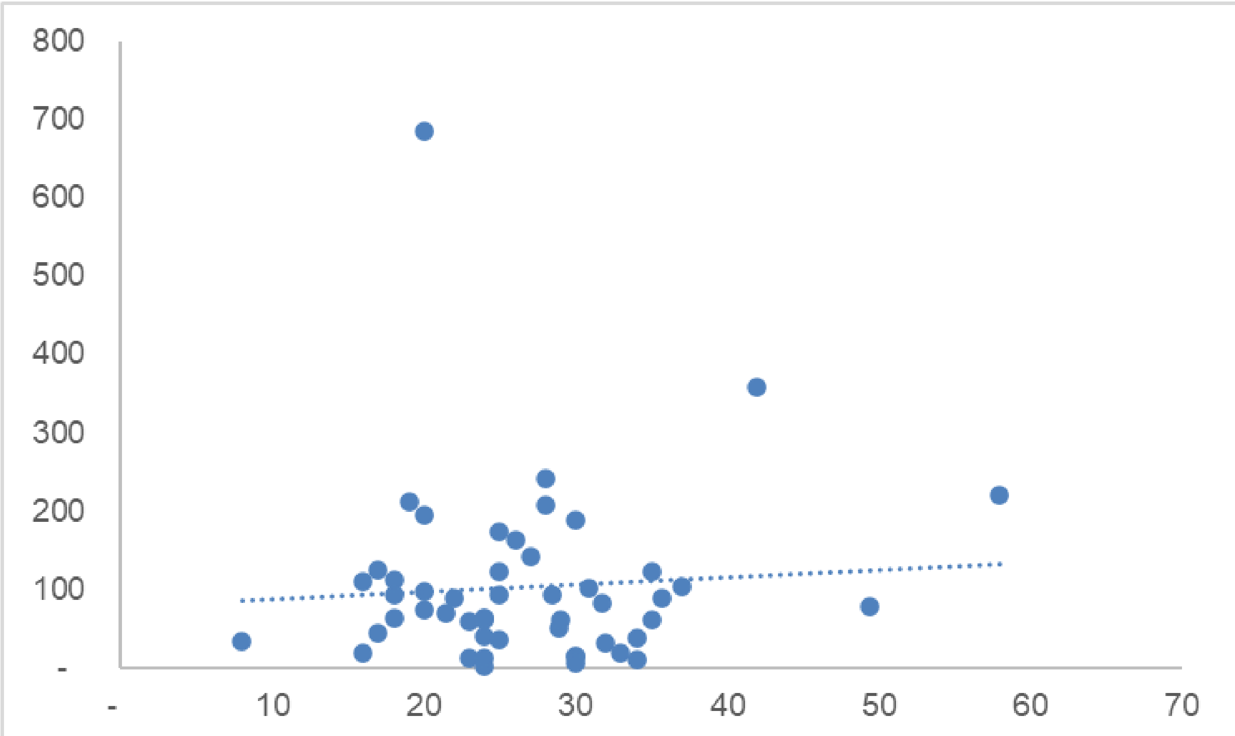

Figure 6. Dot plot of 2020 tax rate on gasoline vs. emission.

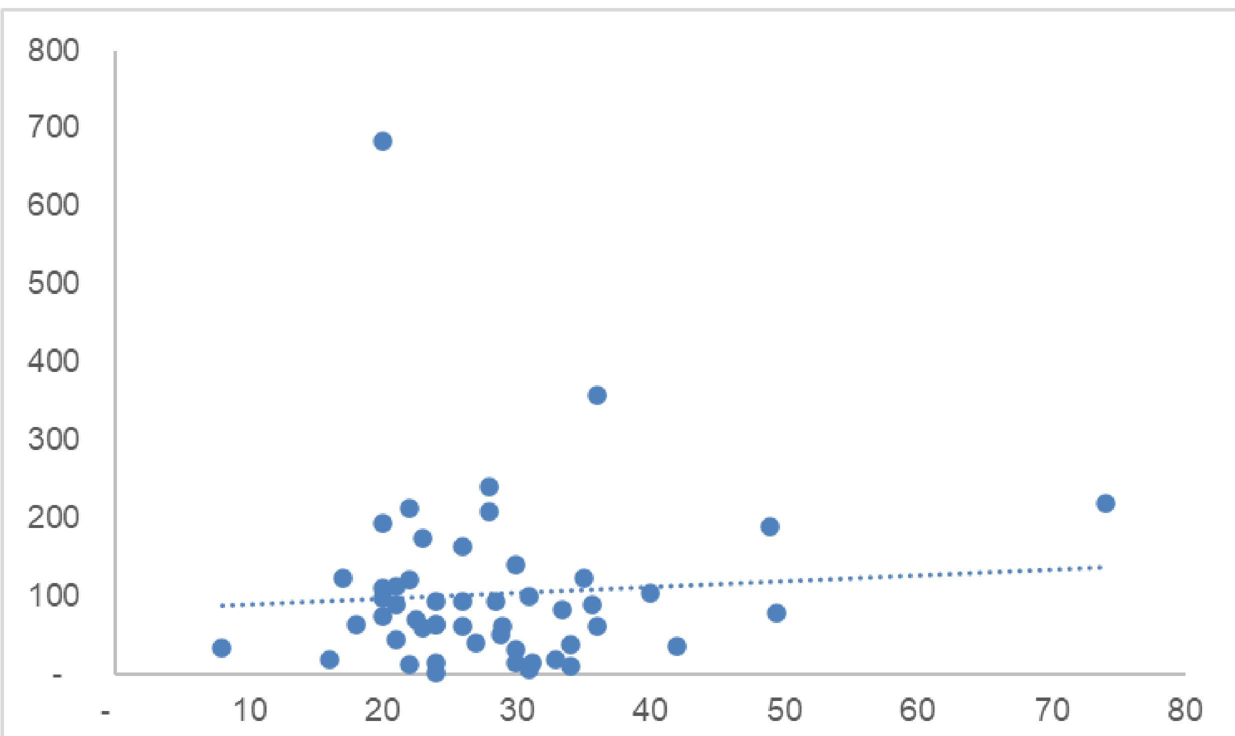

Figure 7. Dot plot of 2020 tax rate on diesel vs. emission.

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.85971056
R Square	0.73910225
Adjusted R Square	0.71641549
Standard Error	55.5262684
Observations	51

ANOVA

	df	SS	MS	F	Significance F
Regression	4	401780.632	100445.158	32.5785709	6.8246E-13
Residual	46	141825.658	3083.16648		
Total	50	543606.29			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	168.078125	52.4480358	3.20466005	0.00245842	62.5057044	273.650545	62.5057044	273.650545
Averaege Income	-0.002139	0.00086211	-2.481178	0.01681179	-0.0038744	-0.0004037	-0.0038744	-0.0004037
Population	1.2532E-05	1.1362E-06	11.0303257	1.6427E-14	1.0245E-05	1.4819E-05	1.0245E-05	1.4819E-05
Tax rate on Gasoline	-0.6853718	0.86892957	-0.7887542	0.4343021	-2.4344364	1.06369266	-2.4344364	1.06369266
Tax rate on Diesel	-0.3400988	0.7374653	-0.4611726	0.64684801	-1.8245395	1.14434185	-1.8245395	1.14434185

Figure 8. Regression Output for 2020

SUMMARY OUTPUT

Regression Statistics	
Multiple R	0.86160644
R Square	0.74236566
Adjusted R Square	0.71996268
Standard Error	58.156132
Observations	51

ANOVA

	df	SS	MS	F	Significance F
Regression	4	448294.068	112073.517	33.1369073	5.1304E-13
Residual	46	155578.242	3382.13569		
Total	50	603872.31			

	Coefficients	Standard Error	t Stat	P-value	Lower 95%	Upper 95%	Lower 95.0%	Upper 95.0%
Intercept	113.629255	55.7131862	2.03953969	0.04716399	1.4844274	225.774082	1.4844274	225.774082
Averaege Income	-0.0009183	0.00096025	-0.9563359	0.34390182	-0.0028512	0.00101456	-0.0028512	0.00101456
Population	1.3295E-05	1.1596E-06	11.4654691	4.4109E-15	1.0961E-05	1.5629E-05	1.0961E-05	1.5629E-05
Tax rate on Gasoline	-5.242502	2.2840284	-2.2952876	0.02632646	-9.8400127	-0.6449913	-9.8400127	-0.6449913
Tax rate on Diesel	3.29194731	1.89267168	1.73931239	0.08866835	-0.5178032	7.10169781	-0.5178032	7.10169781

Figure 9. Regression Output for 2018

Interpretation

Average Income: In 2018, the coefficient is negative but not statistically significant ($p > 0.05$). In 2020, the negative coefficient is statistically significant ($p < 0.05$), suggesting a higher income is associated with lower GHG emissions.

Population: The coefficient is positive and highly significant in both years, indicating a larger population is associated with higher GHG emissions.

Tax rate on Gasoline: The negative coefficient in 2018 is statistically significant, implying that a higher gasoline tax is associated with lower GHG emissions. However, in 2020, the negative coefficient is not statistically significant.

Tax rate on Diesel: The positive coefficient in 2018 is not statistically significant, while the p-value is very low. Based on research, it might be attributed to the low CO_2 emission of diesel cars. In 2020, the negative coefficient is not significant. This suggests there's no clear evidence that diesel tax rates are associated with GHG emissions based on the data provided.

In analyzing the impact of environmental tax policies on greenhouse gas (GHG) emissions, our regression analysis for 2018 and 2020 reveals intriguing insights into the efficacy of such fiscal tools.

- The gasoline tax showed a significant negative relationship with GHG emissions in 2018, suggesting that higher gasoline taxes could contribute to reduced emissions. However, this effect was not statistically significant in 2020 because of the change in people's behavior during COVID-19.

- The tax on diesel did not show a consistent or statistically significant relationship with GHG emissions in either year. The positive coefficient in 2018 and the negative one in 2020 suggest an inconsistent impact, and neither was significant enough to assert a reliable effect.

- The lack of statistical significance in 2020 for gasoline and diesel taxes may be due to various factors during COVID-19. For instance, the shift in consumer behaviors, the changes in external economic factors, and government fiscal policies - potentially not captured by the model.

The significant negative relationship between gasoline taxes and GHG emissions in 2018 suggests that increased gasoline taxes can be a potent tool in a government's policy arsenal to combat climate change. With the clear indication that higher taxes on gasoline correlate with reduced emissions, governments could consider raising gasoline taxes as part of a comprehensive strategy to incentivize the use of cleaner energy sources and discourage the use of fossil fuels. Additionally, the revenue generated from these taxes could be invested in sustainable infrastructure or subsidies for green technology, further amplifying the environmental benefits.

The regression analysis, while insightful, is constrained by the quality of the data and the complexity of the variables influencing GHG emissions. The inclusion of income as a confounding variable in our analysis could influence the observed relationship between tax rates and GHG emissions. While our results suggest a correlation, this association is relatively weak. For potential future study, it will be imperative to incorporate more state-specific variables that could affect the relationship between tax rates and emissions, such as public transit usage, industrial activity, and technological changes in the automotive industry.