To: Lex Luther, CEO, Janzen Consulting Group

From: Data Analysis Team

Date: September 17, 2024

Re: Analysis of Electric Vehicle Population Data in Washington State Department of Licensing (DOL).

Dear Mr. Luther,

We have conducted an analysis of electric vehicle population data that are currently registered through Washington State Department of Licensing (DOL)[1] to inform our consulting strategy for clients in the automotive and energy sectors of our findings. This analysis will help determine if there is a significant relationship between car make preferences and city location, which could affect inventory allocation and marketing strategies.

Our analysis focuses mainly on Cities of Seattle and Spokane as these two cities provide a balance between population demographic and identify if there are any differences in adoption trends between the two. Further we have filtered down our data to choose 3 EV makes - Tesla, BMW and Toyota. Our main goal is to measure if there is any **statistical significance** between the subsetted cities for their preference over EV manufacturers.

Our key takeaways are as follows:

- **Tesla** dominates vehicle ownership in both **Seattle** and **Spokane** as compared with BMW and Toyota.
- There is **no** difference between Seattle and Spokane in terms of the make of the car.

We have conducted univariate analysis on both variables which shows that:

1. Seattle's higher population accounts for more than **10 times** the number of EVs than Spokane.
2. **Teslas** dominate EV market share at a current standing of **over 80%**.

Table 1: Categorical Summary

	Freqency	Percent
City		
Seattle	13700	91.90%
Spokane	1211	8.10%
Total	14911	100.00%
Make		
BMW	1677	11.2%
TESLA	12133	81.4%
TOYOTA	1101	7.4%
Total	14911	100.00%

We have conducted further analysis to observe if there is any difference between Seattle and Spokane in ownership of EVs.

[1] Data.gov. (2024, August 16). *State of Washington - Electric vehicle population data*. https://catalog.data.gov/dataset/electric-vehicle-population-data

Hypothesis Statement

Our analysis uses the chi-square test of independence to assess the relationship between these two categorical variables. We are investigating whether the preference for different car makes is independent of the city in which the purchase is made. Specifically, our research question is: "Is there a statistically significant difference between the city (Seattle vs. Spokane) and the make of the cars purchased (BMW, Tesla, Toyota)?"

We conducted a chi square test with an alpha of 95% confidence. We found that the observed X^2 [2,14911] = 2.01, p=[0.366] does not cross the threshold of the critical chi square value of 5.991. Also the p-value of 0.366 is higher than the alpha value of 0.05. We conclude that there is no statistically significant difference between the two cities. Therefore we fail to reject the null hypothesis.

For further confirmation of our findings, we have provided a bivariate table. The table confirms that Teslas are the preferred EV choice in both .

Distribution of Makes as per the City						
Make	City					
	Seattle		Spokane		Total	Total
	N	PCT	N	PCT	N	PCT
BMW	1537	10.3%	140	0.94%	1677	11.25%
Tesla	11163	74.9%	970	6.5%	12133	81.4%
Toyota	1000	6.7%	101	0.7%	1101	7.4%
Total	13700	91.88%	1211	8.13%	14911	100.0%

Interpretation.

Upon conducting statistical tests, we have observed no significance. However, before we can make any conclusions on the data, we check substantive significance and conduct standardized effect size tests.

Based on the percentage given in the bivariate table above, there is no substantive difference between the two cities.

A Cramer's V test value of **0.011** observed in this dataset is a very low value as per general rule of thumb & therefore there is negligible effect due to size.

Conclusion

The analysis reveals a strong preference for **Tesla** across both cities, with Seattle showing a particularly high concentration of Tesla buyers (**74.9%**). In Spokane, while Tesla remains the most popular, the percentages of BMW and Toyota are notably lower than in Seattle. The statistical power of a test measures the likelihood of correctly rejecting the null hypothesis when it is false. In this case, with a power of **0.21**, the probability of detecting a true effect, if one exists, is quite low (only **21%**). This low power indicates that the test may not have had a sufficient sample size or a strong enough relationship between the variables to reliably detect a significant effect. Therefore, we should interpret the results with caution, as the test may have lacked the sensitivity to capture any meaningful differences.