

Grant Herman

ISYE 2028 Bonus Project

Luxury vs. Non-Luxury Cars, City vs. Suburbs

My project was looking at the proportion of luxury brand cars in Atlanta compared to luxury cars in the suburbs surrounding Atlanta. I chose this project because I am really interested in cars and I think it would be cool to see how different the proportions of luxury cars are. As a parameter to base my data on, I labeled luxury cars as BMW, Audi, Mercedes, Lexus, Tesla, and any of the many exotic cars. I collected data for 1,000 cars in the city and outside of the city on four separate days of 500 cars in each location. I collected data at two different intersections in Atlanta as cars drove by and did the same at two major intersections in one suburb north of Atlanta, and one suburb south of Atlanta. I also collected the data each day at the same time during the day at 2:00pm so I would not include commuter's cars twice during the data. One extra piece of data that I am including in this project is the number of exotic cars in the large samples that I found because they are such rare cars and I would expect a large city to have more of them than surrounding suburbs.

For this study I used a hypothesis test comparing two population proportions setting cars in Atlanta as P_1 and cars in the suburbs as P_2 with the null hypothesis of $P_1 = P_2$ and the

alternate hypothesis of $P_1 > P_2$. For this hypothesis test my test statistic is $Z_o = \frac{(P_1 - P_2)}{\sqrt{P(1-P)\left(\frac{1}{N_1} + \frac{1}{N_2}\right)}}$

and I will reject the null hypothesis if $Z_o > Z_\alpha$. For this project all calculations were done on paper. $P_1 = 0.396$, $P_2 = 0.313$, $P = 0.3545$, $Z_o = 3.8798$, and $Z_\alpha = 1.645$ with a one sided 95% confidence interval. After calculating Z_o and Z_α it is found that Z_o is greater than Z_α so I can reject the null hypothesis and conclude that based on this hypothesis test there is sufficient data

to support that there is a higher proportion of luxury brand cars in Atlanta compared to the surrounding suburbs.

After the hypothesis test I decided to conduct a confidence interval test as well to determine if I am able to reject my null hypothesis with that as well. Using the formula

$CI = [(P1 - P2) - Z\alpha \sqrt{P(1 - P) \left(\frac{1}{N1} + \frac{1}{N2}\right)}, \infty)$ I was able to determine using the same

variables as above that the 95% one sided confidence interval is $[0.047809, \infty)$. Based on the fact that this confidence interval does not contain the value 0, I am able to reject the null hypothesis and confirm for the second time that there is a larger proportion of luxury cars in Atlanta instead of outside in the suburbs.

In conclusion, this project allowed me to use what I have learned in ISYE 2028 this semester to answer a question that is very interesting to me. I was able to successfully collect data on thousands of cars in and around Atlanta and use that data to prove that there is a larger proportion of luxury brand cars in Atlanta compared to cars in suburbs both north and south of the city. I also recorded 2 exotic cars in the suburbs and 3 in Atlanta as the small extra part of my study, confirming the results I was expecting in relation to this subject of the study. This conclusion also matches the hypothesis that I stated in my original project proposal so I am happy with the final results of the study.