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DAT-102 Fall 2019
Final Project Design

Introduction
For my final project I will sample a subsection of gas stations for 2 weeks to determine whether or not there is an ideal day of the week to purchase gas at the lowest price. My single unit of analysis will be the cost of a gallon of unleaded 87 gasoline in US dollars.
I came up with this question while I was filling up my car at a gas station before driving to my in-law's for Thanksgiving. Normally, I would have gravitated towards a domain in which I have higher personal interest like languages or hockey, however I was struck by the fluctuation of gas prices and was curious if there is one particular day of the week when gas was cheapest to buy. It seems to me like the daily fluctuation and volatility of the oil market might disprove this thought so there might some optimal day to purchase gas.

Sampling Procedure
My procedure entailed identifying an area of dense concentration of gas stations of varying companies. It was important to have multiple different companies represented to not bias the data. I elected to sample no more than two of the same gas station companies in my sample population. Every day, at varying times (this was by necessity not choice) I drove down the road and noted the day of the week, date, time, gas station company, gas price per gallon of unleaded 87 octane (i.e. Regular) gasoline, as well as the location of the gas station. In my experiment I ended up with 6 in my sample population (though the first day I had sampled 7). Because gas prices are always displayed regardless of whether or not the station is open, there shouldn't be many variables. In the event the sign, the one visible from the road, is out I would suggest pulling up to a pump and checking the price there. If that process were to fail, I would most likely elect to skip that station for the day all together (however that seems highly unlikely to ever occur).

Hypothesis
I expect that gas prices would be the most expensive on weekends whereas days within the middle of the week (Tuesday through Wednesday) may be the cheapest. My hypothesis is rooted in the assumption that more people will be out on the road shopping for various necessities or traveling, whereas the weekdays are mostly devoted to commuting to and from work which I expected to be fixed distances.

Population Explanation
I chose this population as there was a high density of subjects to sample close to where I lived. I needed this to be the case so that I would be able to sample these subjects daily and as efficiently as possible. They were also from a diverse and locally prevalent gas station brands.

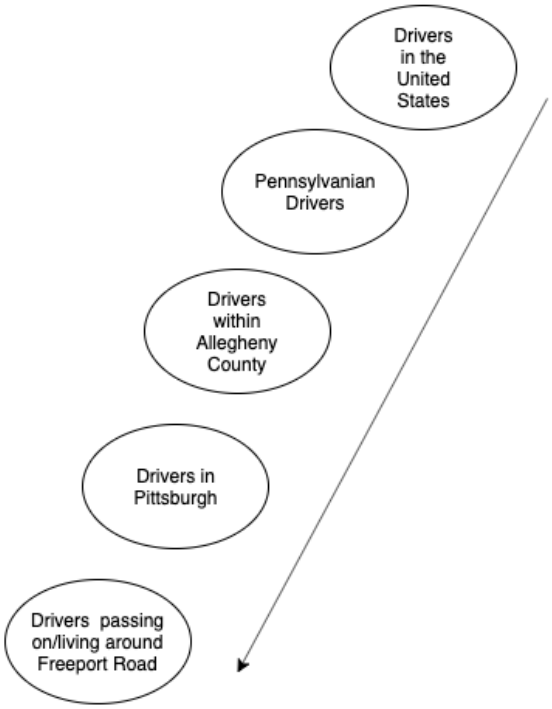
Variables
The variables used for this experiment are: 1) weekday, 2) date of collection, 3) time of data collection, 4) gas station brand, 5) gas station location, and 6) price in USD per gallon of regular.

Journal Articles:
As evidenced in "Redistributive Effects of Gasoline Prices" a "1 percent of an increase in gasoline prices can lead to a reduction in consumer utility ranging between 0.08 percent and 2.76 percent (with an average of 0.82 percent) within the U.S." (Yilmazkuday and Yilmazkuday, 3). With any change or fluctuation in gas prices people are affected albeit at different levels. The article makes a point to note that "welfare costs of an increase in gasoline process are higher for some consumers just because they have lower levels of income" (11). While gas prices affect all people, those below the poverty line and low-income households are most affected by changes in price.

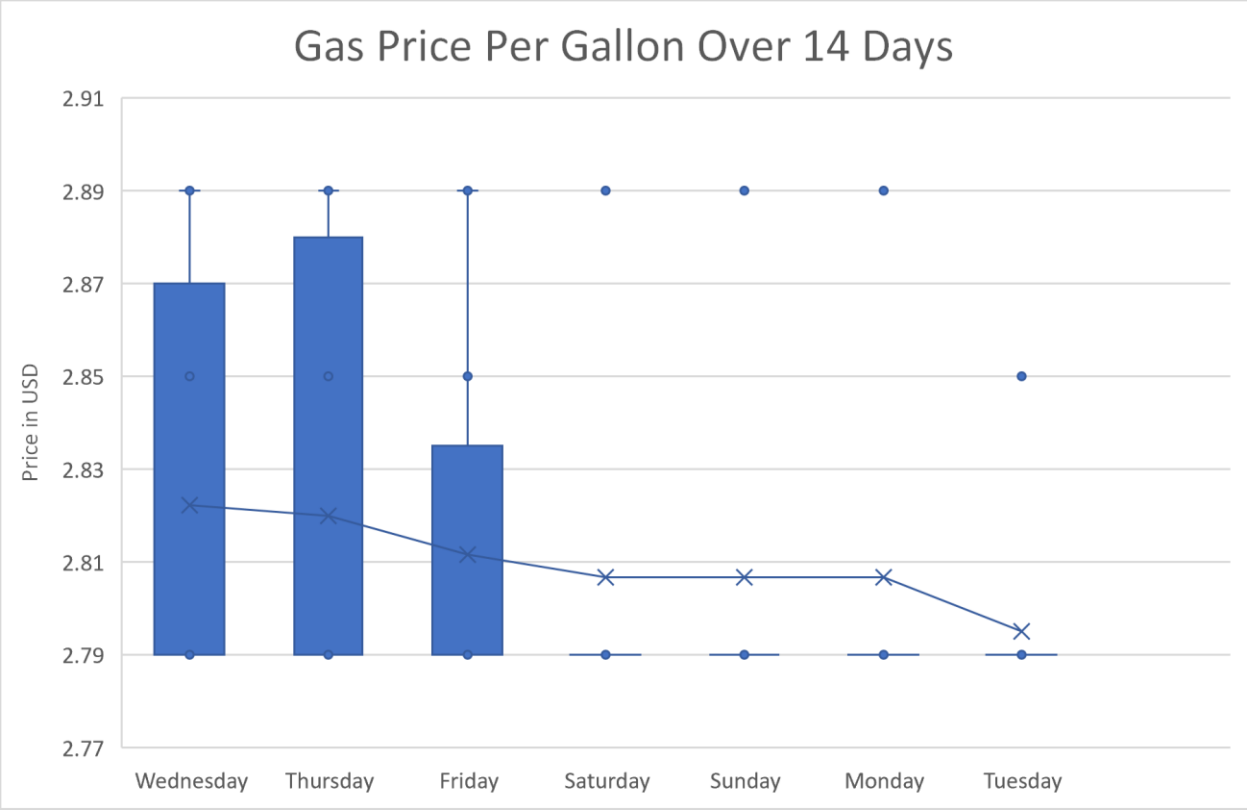
Furthermore, we can understand the impact of gas prices at a macro level, as compared to the micro level in "Redistributive Effects of Gasoline Prices", by examining the results of the study compiled in "The Response of Consumer Spending to Changes in Gasoline Prices" by Gelman et al. They note that the sharp decline of price for gasoline in 2014-2015 included "average saving was more than $1,000, or approximately 2 percent of total spending per household" (Gelman et al., 1). They demonstrate that changes in gasoline prices results in a change in "marginal propensity to consume (MPC)" (1) which can be thought of "as measuring the response of spending to a *permanent, unanticipated* income shock." (1). The study takes an initial venture into the effects of the change in oil prices, while by no means attempting to answer the question holistically. However, the study is important as it establishes that "consumers should respond similarly to an effectively permanent change" (28) in this case gasoline prices.
Both studies bear out the impact of gasoline prices at both the micro- and macroeconomic levels. While my experiment is by no means as thorough or data rich as the aforementioned journal articles it represents a topical and relevant inquiry into an important aspect and cost of people's everyday lives.

Data backed claims:
There is insufficient evidence to make any generalizations or claims about which day of the week is the most ideal to purchase gas. While the mean is lowest on Tuesdays according to the box and whisker plots, we can see from the other statistics that the medians are all identical meaning that Tuesday's mean is skewed due to a low price.
There are also some contextual points to consider. Sampling was begun during the week of Thanksgiving which is traditionally a driving heavy weekend which creates much demand for gas meaning prices could be artificially higher than your average day. Also given that it is winter, a winter blend of gas is used which is less expensive than the summer blend (Gelman et al., 21) meaning the data is biased on one blend.
More data is needed to be able to ascertain whether an optimal day (i.e. cheapest price) truly exists. It would need to factor in holidays, travel seasons, and gasoline blends as well as sample gas stations more randomly over a much longer period of time.

Classification Tree:



Graph of Results:



Works referenced:

Gelman, Michael, et al. *The Response of Consumer Spending to Changes in Gasoline Prices*. University of Michigan, 24 Feb. 2019, http://www-personal.umich.edu/shapiro/papers/gasprices.pdf.

Yilmazkuday, Demet, and Hakan Yilmazkuday. *Redistributive Effects of Gasoline Prices*. Florida International University, 18 Oct. 2018, http://economics.fiu.edu/research/working-papers/2018/1807/1807.pdf.

To my fellow future DAT-102 student,

This project, in particular gathering the data and answering a question I've long mulled over sitting in traffic, was a fascinating experience. For one it was fun to apply the methods and theories we learned in class in the field. I would love to do this on a much larger scale to truly find out whether there is really a best day to buy gas.

When I was out and about gathering my data, I noticed that the numbers didn't fluctuate nearly as much as I had assumed. In fact, they barely changed at all and when they did, the change wasn't particularly significant day over day (though the studies I've cited indicate otherwise). Not much unexpected happened.

I wanted to note that my sampling procedure is flawed and not random in the least. Were I do this data sampling again, I would take greater care to sample gas stations from a more diverse set of locations around Pittsburgh. Having gas stations on the same road and in the same town only represents how gas prices change specific to the area sampled and cannot be extrapolated to the larger area.

Furthermore, a homogenous population of stations doesn't really consider different customer bases or geographies. "Redistributive Effects of Gasoline Prices" by Yilmazkuday and Yilmazkuday notes that the burden of costs is "higher for rural rather than urban areas". It would be a better idea to get some additional stations involved from rural areas to be able to make better generalizations about gas prices. If possible, I would have liked to sample maybe a total of ten gas stations from different areas all around Pittsburgh to better generalize my findings.

Happy data analysis and good luck!

Best,
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