An Analysis of Government Investing Towards Improving the Transportation Sector

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Abstract

With an increase of drivers on the road, the situation of road accidents, traffic congestion, and parking have only worsened. The increase in accidents and idle time have substantially decreased the overall efficiency of each state economy, which decreases the economic efficiency of the entire nation. To combat this problem, many state governments have taken steps to improve infrastructure. The objective of this report is to identify whether the state governments are investing enough in the transport section. The number of hazardous areas in each state, the road impediments and the parking statistics give an insight to the state of transport section in each state. Through our analysis it was observed that Colorado invests commensurate to the demand, while Georgia is not investing enough.

1 Introduction

The increase in accidents have not only made safe travel a more problematic situation, but have also caused government to incur a large economic costs. In 2008, it was estimated that around $35 billion was annually spent by the government due to accidents. In addition, it was estimated that around 23.1% of all motor vehicle costs are covered by government programs such as medicaid and medicare. With over $15 billion due to car accidents falling on the states, it is imperative that proper allocation of resources is done in order to cut this cost down [1]. With the amount of states that already wrestle with proper allocation of finances, it is increasingly important to make sure that investment targeted at improving the current infrastructure is done effectively.

Traffic congestion has had an incredible economic impact in terms of measuring the economic cost of driving to work. It is estimated that a calculation on the amount spent on traffic delays has cost over $ 48 billion annually. This appallingly large number has caused state governments to seriously look into the steps that could be taken to reduce that number. The government in Southern California made meaningful investments in improving roads and building rapid-transit lanes to cut down on the economic cost [2]. Examining examples such as the project in Southern California will provide us with evidence towards developing an understanding of what works and what does not.

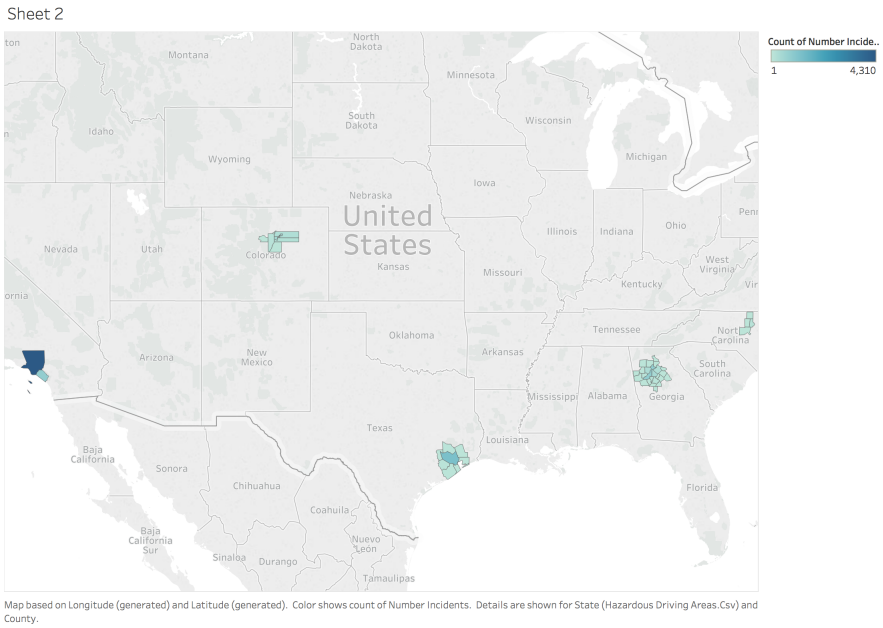
The most surprising economic cost is due to the amount of time spent searching for parking. Incredibly, around $73 billion is the economic cost that drivers across America incur simply for searching for a parking spot. A multitude of factors including overpaying for parking time in order to avoid tickets and avoiding locations based on a lack of parking negatively affect the US economy. In fact, around 39% of Americans avoided certain shopping districts due to the lack of available parking [3]. This incredible amount of generated waste is detrimentally affects our economy and creates a solvable situation in which a loss in potential is preventable.

The importance of using this data to develop cities is incredibly important in order to understand the correct places the money should be spent. The examples of what has worked in other cities will help cities develop properly and increase assurance that the money is being spent properly. This data will be most relevant to the policy makers in government who are focused on investing the state's money properly. This will also interest contractors as they will be hired by these states in order to work on improving the organization of roads. Meaningful investment will cut down future economic costs and decrease the amount spent in the future as a result of failed

improvements to the current infrastructure.

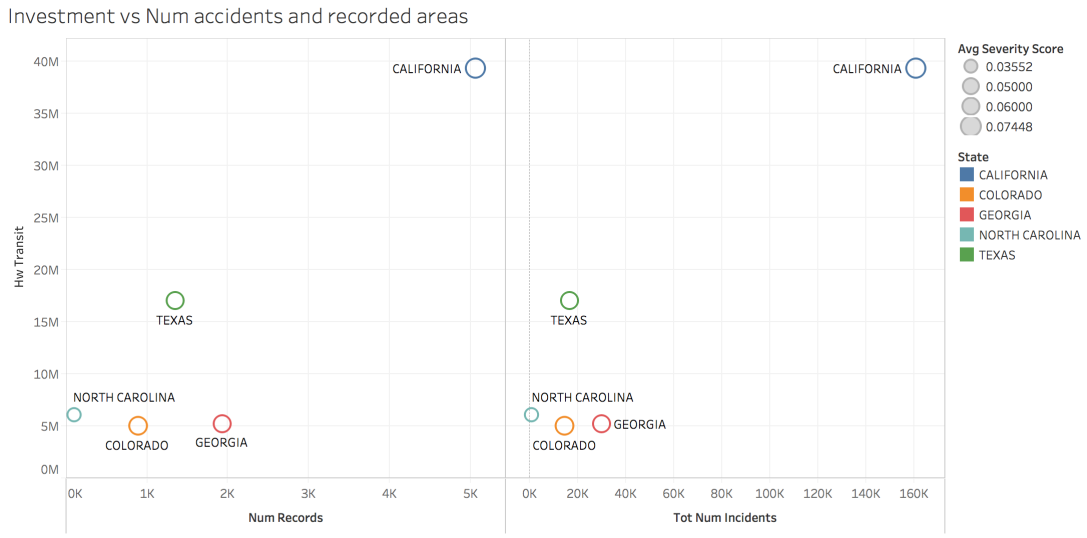
2 Exploratory Data Analysis

We are particularly interested in government finances, road impediments and hazardous area datasets since we want to investigate if the government has spent reasonable amount of money on the facilities. Thus, first we made some plots with the given dataset and wanted to find some patterns in the number of accidents (incidents) in each state versus the investments of that state's government.



Map based on Longitude (generated) and Latitude (generated). Color shows count of Number Incidents. Details are shown for State (Hazardous Driving Areas.Csv) and County.

Figure 2 is the plot of the number of incidents that have happened in the hazardous driving areas and county on the map. It can be seen that California has the largest number of incidents compared to other 4 states. Thus, we wanted to examine if the government of California has invested enough in improving this condition.



Sum of Num Records and sum of Tot Num Incidents vs. sum of Hw Transit. Color shows details about State. Size shows sum of Avg Severity Score. The marks are labeled by State.

Figure 2 gives the relationship between the amount of investment in highway and transit facilities versus the number of recorded hazardous areas and total number of incidents per state. We

can see there is in general a positive relationship between the investment and number of hazardous areas and between the investment and the total number of incidents. California invests the most on the highway and transit facilities and it aligns with the high number of total incidents, indicating that California is making efforts in improving the situation. However, Georgia spends relatively less investments on the facilities, thus the point falls to left of the trend. To further investigate if each state has spent sufficient investments on the facilities, we developed linear regression models to test if there are any linear relationships underlying the data given.

3 Methodology and Results

3.1 Identifying a measure to give a numeric value of the impediments and time spent on parking

Road impediments are often a source of frustration and angst, especially when the impediment has a significant impact on the speed of the car or if it occurs frequently in a particular region or a route. It should be the aim of governments to try to reduce the number of people that are impacted by each impediment and reduce the absolute value of the change in acceleration (since the cars decelerate when passing over the impediment) of the car as a result of the impediment. To achieve the outlined outcomes governments would most likely need to invest in larger roads in areas with potential impediments that affect a large number of commuters who face significant acceleration.

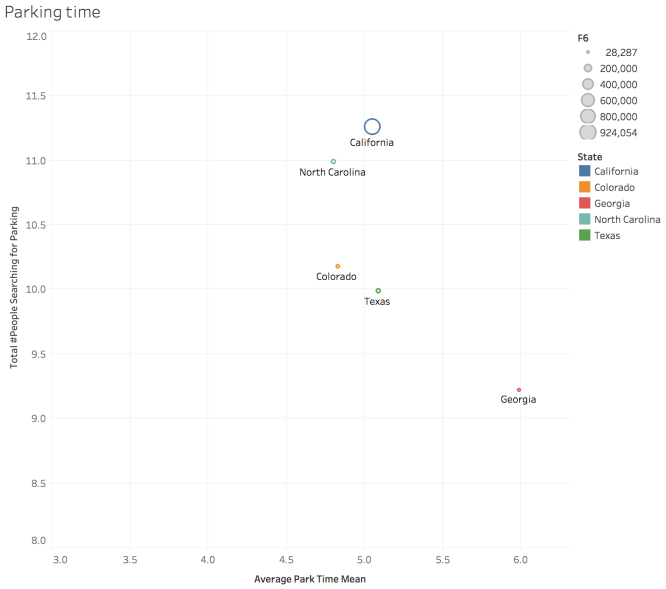
With the data given we can intuitively measure the effect of impediments by finding the number of commuters affected by multiplying the percentage of vehicles that face some acceleration by the average monthly vehicles. This estimate of the people affected still does not take into account the severity of the acceleration that was faced.

There are two possible ways to models the frustration/inefficiency effect of the change in acceleration. The effect can be modeled linearly by just multiplying the absolute value of change in acceleration with the estimated number of commuters. However, this may not be the best model for our scenario, since the commuter frustration intuitively should increase exponentially as the deceleration faced increases. Since we don't have much data on the frustration of commuters or what distribution it follows, we approximated the squared change in acceleration to analyze the effects of considering the logic of exponentially rising frustration. We will use both of these for our analyses, and we can choose which measure to use once more data on impact of magnitude of acceleration change and commuter frustration.

The amount of time spent searching for parking can be linearly modeled as the total drivers searching for parking multiplied by the average amount of time spent searching for parking. This will give us a good estimate for the amount of time lost in the states and give us an understanding for which states have done a proper job of allocating investment.

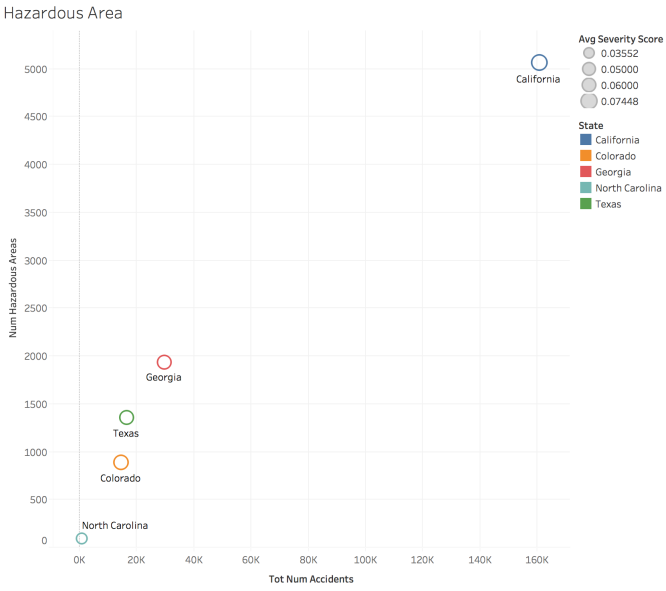
3.2 Linear Regression

To check if the government's investment on highway and transit facilities and parking facilities are reasonable, in the sense that the investments are proportional to the number of incidents, we use a linear regression to check if the states spend sufficient amount of money on improving the facilities.

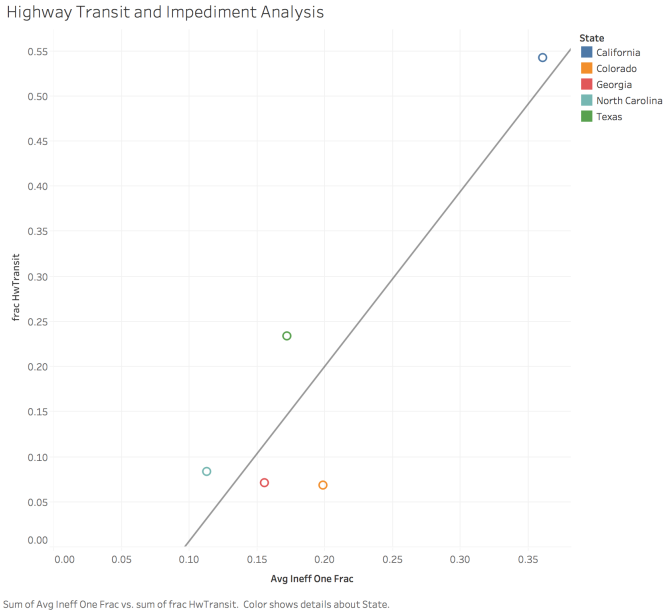


Sum of Average Park Time Mean vs. sum of Total Searching Std. Color shows details about State. Size shows sum of F6. The marks are labeled by State.

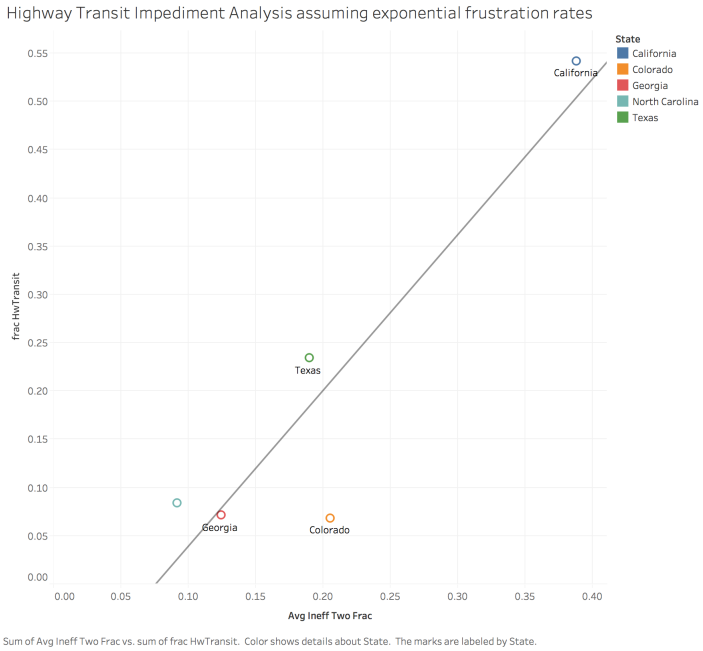
The plot of the parking time versus total number of people searching for parking places is as above. The size of the circles represents the amount of investment spent on parking facilities. We found that California has spent the most to encounter the parking problems. Since the population density of California is higher than other states while the parking time has been similar to others, we can conclude that California has made some efforts on solving the existing parking problems. However, Georgia falls on the right bottom corner indicating that the investment spent on parking is not sufficient and drags Georgia behind other states with respect to parking problems.



Sum of Tot Num Incidents vs. sum of Num Records. Color shows details about State. Size shows sum of Avg Severity Score. The marks are labeled by State.



Assuming that the government is allocating enough funds we should see a linear relation between the performance measures and the relative spending by government in each state to improve each performance measure. Conducting a simple linear regression and subsequently analyzing the coefficient of determination will allow us to assess the strength of the linear relationship and thereby see whether the governments are being efficient in their allocation. In the graph above we can see the relationship between the fraction value of our inefficiency measure derived from the inefficiency from road impediments per state against the fraction of the investment in highways and and transit infrastructure. The coefficient of determination is 0.8931, which suggests that 89.31% of the variation of our response variable (fraction of Highway and Transit expenditure), can be explained by the variation in the inefficiency measure(assumption of linear increase in acceleration leads to linearly increasing frustration). This high value also leads us to believe that the government might be allocating funds based on need, at least with respect to the data that has been collected for road impediments and their impact on traffic flow.



In the graph above we can see the relationship between the fraction value of our inefficiency measure(assuming exponential relation between acceleration change and commuter frustration)

derived from the inefficiency from road impediments per state against the fraction of the investment in highways and and transit infrastructure. The coefficient of determination is 0.9187, which suggests that 91.87% of the variation of our response variable (fraction of Highway and Transit expenditure), can be explained by the variation in the inefficiency measure(assumption of exponential increase in acceleration leads to linearly increasing frustration). This logically better fitting estimate of commuter frustration yields an even higher R^2 value, this leads us to further agree with our previous result, thereby stating that governments are allocating efficiently.

4 Conclusion and Discussion

Through our regression analysis, we were able to determine that Colorado had allocated the funds according to the demand and invested wisely. California was unable to effectively allocate its resources even with such a large investment towards improving its infrastructure. Georgia was inefficient overall due to a lack of investment. In the future, Colorado is a good model to follow when looking to invest in the state's infrastructure.

References

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